Integrated Management Strategy for Arboviral Disease Prevention and Control in the Americas

PAHO
Pan American Health Organization
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Preface

Arthropod-borne viral diseases (known as arboviral diseases) have great potential to become epidemics and, ultimately, pandemics. They represent a constant threat to health worldwide and in the Region of the Americas.

The Region has a long and well-known history of addressing these diseases. The Pan American Health Organization/ World Health Organization (PAHO/WHO) and its Member States have always been at the forefront, planning and implementing campaigns, programs, and strategies against arboviral diseases. In October 1947, PAHO's first Directing Council adopted Resolution CD1.R1, which declared that the solution to the problem of urban yellow fever would be the eradication of *Aedes aegypti* throughout the Americas. The success of that large-scale campaign was demonstrated in 1962, when 18 countries and territories in Region were able to eradicate this vector.

However, by the late 1970s, *Aedes aegypti* was spreading once again in the Americas, demonstrating its great capacity to survive, adapt to urban and domestic life, and transmit several diseases. This has been confirmed with the recent introduction of chikungunya (2013) and Zika virus disease (2015), both of which broke out in the Americas and rapidly spread to almost all areas where the vector is present. The simultaneous circulation of several arboviral diseases poses new challenges for clinical diagnosis and management, laboratory diagnosis, and epidemiological surveillance.

A practically unknown factor that compounded the severity of the situation was the neurological damage caused in fetuses of pregnant women infected by Zika virus (ZIKV). Given this situation, in February 2016, WHO decreed a public health emergency of international concern (PHEIC). PAHO/WHO immediately called on its Member States and organized a response aimed at controlling the outbreak and minimizing its impact. Once a certain level of epidemic control had been achieved, the programmatic phase was implemented, using the Integrated Management Strategy for Dengue Prevention and Control (IMS-dengue) as a methodological model. IMS-dengue was adapted and expanded to become a useful tool to comprehensively tackle arboviral diseases.

It is important to consider the persistent social factors that continue to have a major impact on the outbreak of arboviral diseases, as well as the effects of climate change, which include longer and more intense rainy seasons and hurricanes, facilitating the persistence and rapid spread of these diseases. Furthermore, there are few available vaccines to prevent arboviral diseases and there is still no dengue vaccine recommended for use in immunization programs. As a result, the appearance and reappearance of these diseases can only be controlled through rigorous prevention and control measures. These measures must be sustainable and comprehensive in order to prevent the proliferation of disease-transmitting mosquitoes, provide timely clinical diagnosis, strengthen epidemiological surveillance that is coordinated with solid laboratory support, while actively including society in the control of the vector's breeding sites. It is also necessary to promote research aimed at identifying critical aspects of basic research, clinical research, services, health systems, and public health, setting priorities and coordinating work to generate scientific knowledge that is useful for decision-making, and implementing efficient actions and programs for prevention and control.

This document, entitled *Integrated Management Strategy for Arboviral Disease Prevention and Control* (IMS-arbovirus), was prepared during technical consultation with the countries in Colombia in 2016, based on the experiences gained from best practices in each component of the national IMS-dengue strategies

and the recommendations made by experts and scientists in the International Technical Group of Experts on Arboviral Diseases (GT-Arbovirus). IMS-arbovirus also includes the recommendations made by the countries of the Americas during the 55th PAHO/WHO Directing Council (2016) and in subsequent technical meetings held in Cuba (2016) and Guatemala (2018), with the participation of country managers and experts from each component of IMS-dengue.

This makes IMS-arbovirus a solid technical document, a model for methodological work aimed at developing and strengthening national strategies throughout the Region, and a valuable reference tool for the countries and territories of the Americas to plan activities for the prevention and control of arboviral diseases. National strategies should take a multidisciplinary approach within an extrasectoral framework that involves families and communities in solving the problem in order to mitigate the risk of transmission and control or reduce the negative health impact of outbreaks.

Methodology

The *Integrated Management Strategy for Arboviral Disease Prevention and Control* (IMS-arbovirus) is based on the IMS-dengue technical document published by PAHO/WHO. In the preparation of this document, two moments of particular importance stand out.

First, in August 2016, a technical consultation was held with representatives of the health ministries of the countries and territories of the Americas, members of GTI-Dengue (now known as GT-Arbovirus), and technical personnel of PAHO/WHO. The participants in this workshop expanded IMS-dengue to include other arboviral diseases of public health importance, organizing themselves in working groups according to their area of experience (managers, epidemiologists, clinicians, virologists, entomologists, social scientists, and communications specialists). As a result, IMS-arbovirus has a work model with five components: management, epidemiology, patient care, laboratory, and integrated vector management; and two cross-cutting linchpins for each component: operations research and communication for behavioral impact. Factors that facilitate implementation of the strategy at the regional and national levels are also included: advocacy, resource mobilization, partnerships, capacity building, monitoring, and evaluation.

In October of the same year, representatives of the health ministries of the 34 Member States and PAHO/WHO technical personnel presented and discussed the first draft at an international meeting in Havana, Cuba.

The second important moment in the development of IMS-arbovirus was a regional workshop in April 2018, where 14 countries and territories, members of GT-Arbovirus, and PAHO/WHO technical personnel reviewed and updated the IMS-arbovirus technical document, based on the lessons learned by the countries after almost two years of implementing their national programs for arboviral disease prevention and control. The working methodology was similar to the one used during the technical consultation described above, but with a new expert working group on the subject of the environment. This new environmental component of IMS-arbovirus considers the importance of interprogrammatic and intersectoral work, as well as socioenvironmental factors and determinants that play a significant role in the dynamics of the transmission of these diseases.

On both occasions, PAHO/WHO technical personnel were responsible for consolidating the information provided by the working groups, and for the review and final editing of the document.

Acknowledgments

PAHO/WHO would like to express its most sincere gratitude to the technical teams from the countries and territories of the Americas who, in the preparation of this document, shared their knowledge and lessons learned. PAHO/WHO also thanks the International Technical Group of Experts on Arboviral Diseases (GT-Arbovirus) for their technical support in reviewing and updating this document, and for their constant support in the technical cooperation activities provided to the countries and territories of the Americas on the subject of arboviral diseases.

The annexes to this document contain detailed lists of the health professionals who participated in the technical consultation and in the regional workshop for the review and update of IMS-arbovirus.

We offer special thanks to the ministers of health and representatives of the countries and territories of the Americas who attended the 55th PAHO/WHO Directing Council and adopted Resolution CD55.R6, demonstrating that 10 years of work on IMS-dengue provided the essential platform for organizing an integrated response to the complex situation posed by vector-borne diseases today.

Abbreviations and acronyms

Ae.	*Aedes*
CHIKV	Chikungunya virus
COMBI	Communication for behavioral impact
DENV	Dengue virus
EQA	External quality assessment
GT-Arbovirus	International Technical Group of Experts on Arboviral Diseases
GTI-Dengue	International Technical Group of Experts on Dengue
IHR	International Health Regulations
IMS-arbovirus	Integrated Management Strategy for Arboviral Disease Prevention and Control in the Americas
IMS-dengue	Integrated Management Strategy for Dengue Prevention and Control
IVM	Integrated vector management
NRL	National reference laboratory
PAHO	Pan American Health Organization
PHEIC	Public health emergency of international concern
PLISA	Health Information Platform for the Americas
RELDA	Arbovirus Diagnosis Laboratory Network of the Americas
RELEVA	Entomological-virological laboratories network of the Americas
SDGs	Sustainable Development Goals
SWOT	Strengths, weaknesses, threats, and opportunities
WHO	World Health Organization
ZIKV	Zika virus

1. Introduction

Epidemic and potentially pandemic diseases pose a permanent threat to global and regional health security. In recent years, the global incidence of arboviral diseases has increased despite the efforts that countries have made to control the vectors. The Region of the Americas is no exception, being affected not only by the presence of dengue virus (DENV), but also by the recent introduction of chikungunya virus (CHIKV) in late 2013 and Zika virus (ZIKV) in 2015. Tackling the simultaneous circulation of three arboviruses poses a new challenge in every country and territory of the Americas.

In response to the epidemiological situation created by dengue, PAHO/WHO and its member countries jointly prepared the Integrated Management Strategy for Dengue Prevention and Control (IMS-dengue) in 2003. By 2015, IMS-dengue had been implemented in 26 countries and territories of the Americas and evaluated on 32 occasions. It had proven to be a flexible, adaptable, dynamic, and sustainable methodological model over time. However, with the emergence of new arboviral diseases in the Americas, it became necessary to expand the integrated approach beyond dengue to other arboviral diseases of public health importance. Accordingly, PAHO/WHO undertook the development of the Integrated Management Strategy for Arboviral Disease Prevention and Control (IMS-arbovirus), a strategy built on the basis of IMS-dengue and the lessons learned from the countries and territories facing this new epidemiological situation. The technical document for IMS-arbovirus was prepared through technical consultation (August 2016) and a subsequent review and updating process (April 2018), with the participation of countries and territories, experts in arboviral disease, members of GT-Arbovirus, and PAHO/WHO technical personnel.

The goal of this document is to help reduce the burden of disease caused by arboviruses, within the framework of the Sustainable Development Goals (SDGs) of the United Nations Development Program (UNDP). Through health promotion and the prevention, surveillance, and control of arboviral diseases, the aim is to reduce the morbidity, acute and chronic effects, birth defects, and deaths caused by these pathologies. The IMS-arbovirus work model proposes six components to address arboviral diseases: management, epidemiology, patient care, laboratory, integrated vector management, and environment. Operations research and communication for behavioral impact (COMBI) are cross-cutting linchpins of each component. Finally, the model relies on factors that facilitate implementation of the strategy at the regional and local levels.

Performance indicators and expected results have been developed for each component. In addition, necessary activities and tasks have been established and the persons responsible for implementing them has been specified. This document also provides detailed guidelines for implementation and for the respective monitoring and evaluation processes. IMS-arbovirus is designed mainly for health ministers, health managers, managers of national arboviral disease prevention and control programs, and directors of hospital and primary health care centers. This document provides them with the necessary high-level, practical, technical guidance to support and strengthen national and local management capacities for arboviral disease prevention and control.

2. Epidemiological context of arboviral diseases in the Americas

In recent years, conditions in the Region of the Americas have been highly favorable for the introduction and spread of arthropod-borne viral infections (arboviral diseases). Although dengue has been circulating for over 400 years, the number of cases reported since the year 2000 represents an unprecedented increase, with four serotypes in circulation. Since that year, 19.6 million cases of dengue have been reported to PAHO/WHO, including more than 800,000 severe cases and over 10,000 deaths. In 2015 and 2016 alone, more than 4.8 million cases were reported, 17,000 of them severe, resulting in 2,000 deaths. Despite a 23% reduction in the dengue case-fatality rate in the last six years (from 0.069% to 0.053%), the continued risk of severe disease and even death poses a serious public health problem in the Americas.

Dengue continues to be the most prevalent arboviral disease in the Americas. However, in recent years our Region has been particularly affected by the appearance of other arboviruses, such as chikungunya and Zika. In December 2013, the chikungunya virus was detected for the first time in the French territory of Saint Martin. It spread rapidly from the Caribbean to the north coast of South America and Central America. By the end of 2015, the transmission of chikungunya virus was documented throughout the hemisphere, with an average cumulative incidence of 302 cases per 100,000 population.

Although it is not known exactly when and where Zika virus was introduced to the Americas, by November 2014 it had been observed in patients in northeastern Brazil who presented skin rashes compatible with the disease. In May 2015, national authorities officially reported the presence of Zika virus in Brazil, causing PAHO/WHO to issue an epidemiological alert advising the countries and territories of the Region to step up surveillance in preparation for a possible introduction of the virus in the entire continent. In the months following this epidemiological alert, most countries and territories in the Americas reported local transmission of the disease. Since its initial detection, more than one million cases of Zika virus disease have been officially reported throughout the Region.

It is no surprise that an outbreak of this magnitude has helped increase our understanding of the Zika virus, while expanding the observed clinical spectrum of the disease. Although Zika virus was identified for the first time in 1947, in Uganda, the current outbreak in the Americas has generated more knowledge about this pathogen than all previous outbreaks combined. However, questions persist regarding the overall magnitude of the outbreak, modes of transmission other than the vector, and the specific nature of the central nervous system anomalies caused both by primary infection and intrauterine infection.

Today, arboviruses present an extremely complex and unstable epidemiological situation, given the simultaneous epidemic circulation of three arboviral diseases and the risk that others could become epidemics, for example, Mayaro fever. Countries are aware that this complex situation can only be addressed with a comprehensive and multidisciplinary approach.

3. Background: from IMS-dengue to IMS-arbovirus

The development of IMS-arbovirus is part of a history of technical cooperation between PAHO/WHO and the countries and territories of the Americas. It is based on the lessons learned during the development and implementation of national IMS-dengue programs in recent years. This history of cooperation is not new. It dates back to October 1947, with the adoption of Resolution CD1.R1 during the first Directing Council of PAHO. This resolution stated that the solution to the problem of urban yellow fever would be the eradication of *Ae. aegypti* in the entire hemisphere. The success of that campaign was demonstrated in 1962, with the eradication of this vector in 18 countries in the Region and several Caribbean islands.

Unfortunately, the effectiveness of these efforts waned in the period 1962-1972 due to their lack of priority in public health policy and because of *Ae. aegypti* resistance to dichlorodiphenyltrichloroethane (DDT), the main residual pesticide used at the time. This gave rise to the reintroduction and rapid geographic spread of the mosquito, which soon resulted in epidemic outbreaks of dengue. In the 1990s, resolutions CD38.R12 (1995) and CD39.R11 (1996) were adopted as a vector control strategy, with the goal of preparing and implementing a hemispheric plan for *Ae. aegypti* eradication. However, a scarcity of resources and a lack of common criteria at the hemispheric level prevented adequate implementation of this hemispheric plan, and the expected results were not achieved.

In September 2001, the 43rd Directing Council of PAHO/WHO adopted Resolution CD43.R4 on the new generation of dengue prevention and control programs. Its aim was to strengthen implementation of social communication measures in national programs through an approach focused more on changing the behavior of the population than on disseminating information and knowledge. Thus, the Communication for Behavioral Impact (COMBI) strategy was created as a social mobilization and communication methodology with a behavioral approach to diseases, including dengue. The addition of the behavioral approach to the mobilization model guarantees that programs, whose budgets and human resources are often very limited, can optimize resources with respect to the actual impact they hope to have on the behavior of individuals and social groups.

In keeping with the approach proposed in 2001 to address the epidemiological situation of dengue and given the steady increase in cases of this disease in the Region, in 2003 PAHO/WHO adopted Resolution CD44.R9, which introduced a new prevention and control model known as IMS-dengue. This strategy included five basic components for the prevention and control of the disease: patient care, epidemiology, laboratory, integrated vector management, and social communication. Management, environment, and vaccine components were added later. As a result, in 2007 the Pan American Sanitary Conference adopted Resolution CSP27.R15, which urged the Member States to strengthen the implementation and evaluation mechanisms of IMS-dengue. In 2012, IMS-dengue was aligned with WHO's updated global dengue prevention and control strategy, with the inclusion of facilitating factors for implementation at the national level. In 2014, at a meeting on the latest technical advances in dengue prevention and control in the Region of the Americas, held at PAHO/WHO Headquarters in Washington D.C., this strategy was reiterated and multilaterally reviewed by national health ministries, academia, private industry, and WHO collaborating centers in the Region, among others. Their conclusion was that implementation of IMS-dengue had provided countries and territories with a sound methodological tool for dengue prevention and control, thus improving their response to a complex situation in which multiple factors and social determinants interact in the transmission process.

Between 2003 and 2015, IMS-dengue was implemented in more than 26 countries and territories in the Region and evaluated on 32 occasions. IMS-dengue has been field-tested in different countries and epidemiological contexts, has been improved technically and operationally over time, and is a knowledge-based technical strategy that has political support. IMS-dengue has proven to be a flexible, adaptable, dynamic, and sustainable methodological model for the Region.

However, in light of the advance of dengue and the recent introduction of new arboviral diseases in the countries and territories of the Americas, it became necessary to take IMS-dengue and make it a useful tool to comprehensively tackle other arboviral diseases. In June 2016, during the 158th session of the Executive Committee, PAHO/WHO recommended adopting the Strategy for Arboviral Disease Prevention and Control (IMS-arbovirus). Resolution CD55.R6 urged Member States to strengthen their epidemiological and entomological surveillance systems, strengthen their capacity to diagnose and detect arboviral diseases, and prepare a strategy for integrated control of arboviral diseases, taking into account the critical components of IMS-dengue.

There are four strategic lines of action:

1. Foster an integrated approach for arboviral disease prevention and control;
2. Strengthen health services capacity for the differential diagnosis and clinical management of arboviral diseases;
3. Evaluate and strengthen country capacity for surveillance and integrated vector control;
4. Establish and strengthen the technical capacity of the Arbovirus Diagnosis Laboratory Network in the Region of the Americas (RELDA).

IMS-arbovirus consists of five components (management, epidemiology, integrated vector management, patient care, and laboratory), a cross-cutting linchpin for each component (operations research and communication for behavioral impact), and facilitating factors (advocacy, resource mobilization, partnerships, capacity-building, monitoring, and evaluation). Unlike IMS-dengue, this version of IMS-arbovirus did not include an environment or vaccine component.

After the health emergency declared by WHO due to the Zika epidemic had ended in November 2016, it was necessary to update IMS-arbovirus and focus it on the countries' programmatic work. To accomplish this, representatives of health ministries of 14 countries and territories of the Americas, GT-Arbovirus members, and PAHO/WHO technical personnel held a technical workshop in Guatemala City in April 2018. This IMS-arbovirus document is the product of that workshop, where it was reviewed and updated with a new component: environment (Figure 3-1).

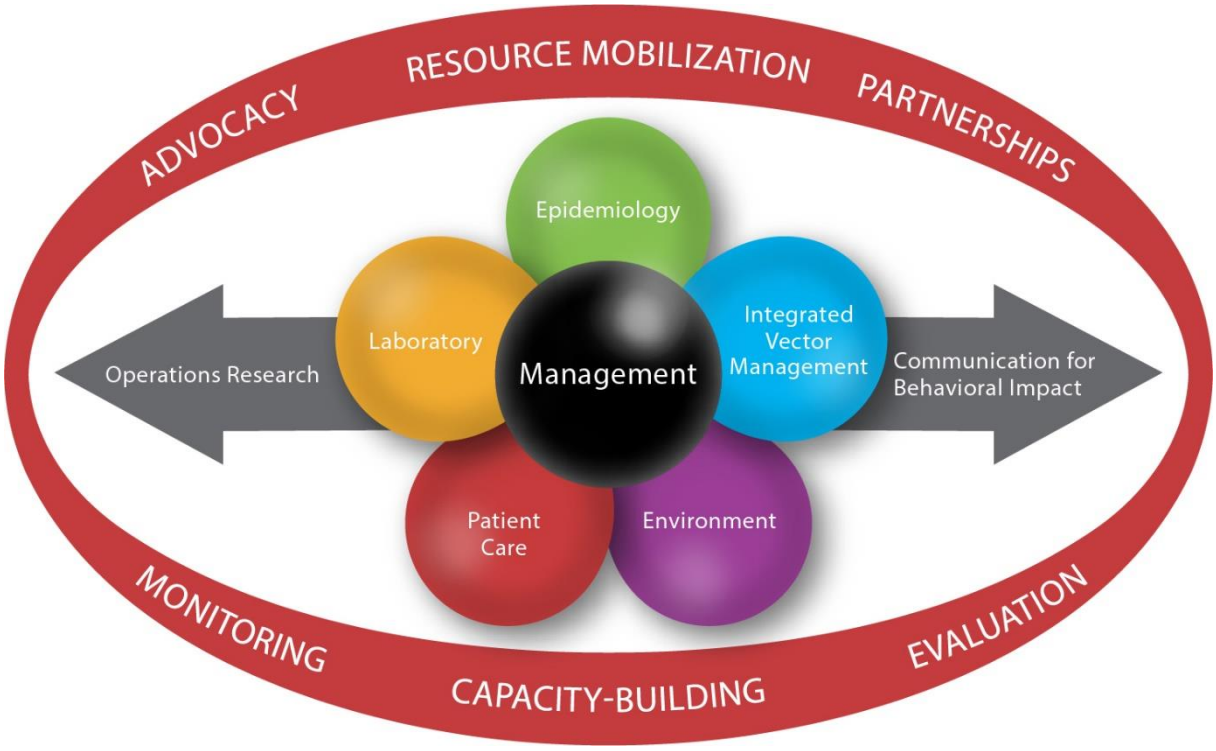

Figure 3-1. The Integrated Management Strategy for Arboviral Disease Prevention and Control (IMS-arbovirus)

In the IMS-arbovirus model, each of the four strategic lines of action are harmonized and aligned.

- **Strategic line of action "1"** (Foster an integrated approach for arboviral disease prevention and control) is reflected in the IMS-arbovirus as a whole. It involves the components of management, epidemiology, integrated vector management, laboratory, and patient care, and the linchpins of operations research and communication for behavioral impact.
- **Strategic line of action "2"** (Strengthen health services capacity for the differential diagnosis and clinical management of arboviral diseases) seeks to ensure timely clinical identification and differential diagnosis. It is reflected mainly in the patient care component.
- **Strategic line of action "3"** (Evaluate and strengthen country capacity for surveillance and integrated vector control) is reflected in the components of epidemiology, environment, and integrated vector management, as well as in the facilitating factors (monitoring and evaluation).
- **Strategic line of action "4"** (Establish and strengthen the technical capacity of RELDA) is reflected in the laboratory, patient care, and epidemiology components.

The goal, purpose, components, and facilitating factors of IMS-arbovirus are detailed below.

4. Goal, purpose, and components of IMS-arbovirus

4.1 Goal and purpose of IMS-arbovirus

Goal:

Help to reduce the burden of arboviral diseases within the framework of the Sustainable Development Goals (SDGs) of the United Nations Development Program (UNDP).

Purpose:

Implement the Integrated Management Strategy for Arboviral Disease Prevention and Control in the countries of the Region, including health promotion, prevention, surveillance, and arboviral disease control in order to reduce the morbidity, acute and chronic effects, birth defects, and deaths caused by these pathologies.

4.2 Management component

Integrated management is a methodological model for the planning, organization, implementation, monitoring, and evaluation of strategies for the surveillance, prevention, and control of arboviral diseases, based on an integrated, intra- and inter-institutional, multidisciplinary, and cross-sectoral vision.

The implementation of IMS-arbovirus contributes to decision-making at the following levels:

- **Political:** to advocate for defined roles and functions in the sectors involved in arboviral disease prevention and control, based on the information provided by the health sector (regulatory institution). This level is linked with maintaining and fostering political will and financial commitment at the highest decision-making levels.
- **Strategic:** to develop the technical guidelines for each step and in the different socioeconomic and epidemiological scenarios at the regional, country, and subregional levels.
- **Operational:** to plan, implement, monitor, and evaluate interventions against arboviral diseases in a way that is consistent with decisions at the political and strategic level; and to facilitate the adaptation and operationalization of processes to local circumstances.

Table 4-1. Results, indicators, verification sources, assumptions, and risks: management component

Results	Indicators	Verification sources	Assumptions/Risks
R1 All countries in the Region have adopted, adjusted, and implemented IMS-arbovirus	Number of countries that have adopted, adjusted, and implemented IMS-arbovirus / total number of countries of the Region Number of countries that have a national GT-Arbovirus / total number of countries in the Region Number of countries that have a national IMS-arbovirus steering group (coordinator) / total number of countries in the Region	National IMS-arbovirus document adjusted to the country's special features and adopted by ministerial resolution IMS-arbovirus annual operating plans Report on implementation of the annual operating plan Report on PAHO/WHO visit to the countries confirming fulfillment of IMS-Arbovirus	**Assumptions:** Countries maintain political commitment and allocation of financial resources for implementation of IMS-arbovirus Health resources are reorganized or reorganizable for adequate implementation of IMS-arbovirus Institutional, sectoral, and intersectoral coordination and integration exists or is feasible, with a multidisciplinary approach and with the participation of social stakeholders **Risks:** Economic or political fluctuations in the countries may affect continuous implementation of IMS-arbovirus Limited political will may limit sectoral and extra-sectoral participation Persistence of a work culture unamenable to integration

Table 4-2. Results and activities: management component

Results	Activities
R1 All countries in the Region have adopted, adjusted, and implemented IMS-arbovirus	**R1A1** Prepare a new national document adapting the regional IMS-arbovirus to the characteristics, needs, and capacities of each country
	R1A2 Implement the national IMS-arbovirus
	R1A3 Develop and execute an IMS-arbovirus monitoring and evaluation plan in each country
	R1A4 PAHO/WHO support for countries in the process of adjusting and implementing their national IMS-arbovirus
	R1A5 Establish permanent, evidence-based improvement processes during implementation

Table 4-3. Activities, tasks, time frames, and responsible institution or person: management component

Activities	Tasks	Time frame*			Responsible institution / person	Observations
		S	M	L		
R1A1 Prepare a new national document adapting the regional IMS-arbovirus to the characteristics, needs, and capacities of each country	1. Designation of a national coordinator for IMS-arbovirus	X			Ministry of Health or its equivalent	
	2. Creation of a national technical group of experts on arboviral diseases (national GT-Arbovirus) and of the steering group (coordinator) of the national IMS-arbovirus	X			Ministry of Health or its equivalent, with support from the international GT-Arbovirus and PAHO	GT-Arbovirus should consist of representatives of each component of IMS-arbovirus and partners, if necessary. The steering group of the national IMS-arbovirus should consist of directors of key areas (epidemiology, health services, laboratory, health promotion, environment, planning).
	3. Adaptation of the national IMS-arbovirus, based on the regional document	X			Ministries of Health, IMS-arbovirus coordinator, national GT-Arbovirus with support from PAHO and international GT-Arbovirus	
R1A2 Implement the national IMS-arbovirus	1. High-level authorities help to identify and call on extra-sectoral actors to establish commitments, roles, and functions	X			Ministry of Health	
	2. Arrange for the necessary resources for correct implementation	X			National coordinator of IMS-arbovirus and national GT-Arbovirus	It is necessary to take into account the budgets of other involved sectors, in addition to the health sector.

Activities	Tasks	Time frame*			Responsible institution / person	Observations
		S	M	L		
	3. Implement the national IMS-arbovirus	X	X	X	National coordinator of IMS-arbovirus, national GT-Arbovirus, and subnational managers	This task includes the use of existing national operating plans
R1A3 Develop and execute an IMS-arbovirus monitoring and evaluation plan in each country	1. Convene the national GT-Arbovirus to develop the monitoring and evaluation plan, including external evaluations	X			National IMS-arbovirus coordinator	
	2. Implement monitoring and evaluation of all components of IMS-arbovirus, based on the regional evaluation instrument		X	X	National GT-Arbovirus and external evaluators	
R1A4 PAHO/WHO support for countries in the process of adjusting and implementing their national IMS-arbovirus	1. Disseminate the new version of IMS-arbovirus with the countries	X	X	X	PAHO/WHO	
	2. Hold regional meetings to bring together the different national GT-Arbovirus groups, to conduct revisions and move forward with implementation	X	X	X	PAHO and countries	
	3. Hold regional workshops to educate national IMS-arbovirus managers	X			PAHO and countries	
	4. Support the countries with lines of technical cooperation that respond to the emerging needs identified during the adjustment and implementation process	X	X	X	PAHO	
R1A5 Establish permanent, evidence-based improvement processes	1. Define the lines of operations research, based on a needs diagnosis for each component of the IMS-arbovirus and each country	X	X		National IMS-arbovirus coordinator and national GT-Arbovirus	
	2. Form a network to research arboviral diseases in the Americas	X	X	X	PAHO and national GT-Arbovirus	

Activities	Tasks	Time frame*			Responsible institution / person	Observations
		S	M	L		
	3. Establish guidelines for the call for operations research proposals	X	X	X	National IMS-arbovirus coordinator and national GT-Arbovirus	
	4. Offer the countries generic protocols for operations research on the different components, taking into account bioethical aspects	X	X	X	PAHO	

*Time frame: S=short-term (1 year), M=medium-term (2-4 years), L=long-term (5+ years)

4.3 Epidemiology component

The integrated epidemiological surveillance system for arboviral diseases is one of the basic and essential elements for managing arboviral disease prevention and control programs in the countries of the Region of the Americas. A timely and effective integrated surveillance system provides information for identifying high-risk situations and facilitates the design of interventions both in ordinary situations and in response to outbreaks and epidemics. The information generated by this surveillance system should permit a comprehensive analysis of information from the different components: epidemiology, integrated vector management, laboratory, environment, and patient care.

Integrated epidemiological surveillance means:

- The process of integrating information among the subsystems of the different components on a single platform or through a platform interface;
- Comprehensive information analysis;
- Developing prevention and control activities based on the generated information.

The evaluations of the national IMS-dengue strategies have shown progress in the environment component, including greater availability of information for calculating incidence and case-fatality, information on circulating viruses, and entomological surveillance data, as well as the development of tools that facilitate the acquisition of real-time information. IMS-arbovirus will help consolidate this progress, improving the information on the circulating chikungunya and Zika viruses. Although this information is currently limited to a few countries, it will be of great help in developing a regional proposal for a generic protocol for integrated epidemiological surveillance of arboviruses (dengue, chikungunya, and Zika) in the Americas. The content of this protocol would not be limited to epidemiological surveillance of dengue, chikungunya, and Zika, but would also include indicators form other subsystems of entomological and laboratory surveillance, as well as the inclusion of social and environmental indicators related to the dynamics of transmission of these diseases.

A critical issue identified in the Region's integrated epidemiological surveillance is the lack of standard operational definitions and risk indicators to facilitate, among other things, stratification, a more accurate estimate of the burden of these diseases, and comparison of the data from all countries and territories.

The objectives of the integrated epidemiological surveillance system for arboviral diseases are to:

- Identify outbreaks and epidemics in a timely manner;
- Provide data for assessing the social and economic impact on affected communities;
- Monitor trends in the distribution and spread of dengue, chikungunya, and Zika in time, place, and person;
- Describe the circulation of the different DENV, CHIKV, and ZIKV serotypes and lineages and their potential clinical correlation with cases occurring in the same period;
- Include environmental, clinical, laboratory, and entomological surveillance information in the epidemiological analysis;
- Monitor the effectiveness of clinical management and improve the clinical characterization of diseases;
- Detect and characterize deaths from dengue, chikungunya, and Zika; and ensure surveillance of populations at risk, such as pregnant women, and other complications caused by arboviruses;
- Provide the necessary information to evaluate the effectiveness of dengue, chikungunya, and Zika prevention and control programs in order to facilitate planning and resource allocation, capitalizing on the lessons learned from the IMS-dengue evaluation in the different countries;
- Generate information that permits timely decision-making for actions to prevent and control arboviral diseases.

The integrated epidemiological surveillance system could include sentinel surveillance, a modality that until now has not usually been included in epidemiological surveillance systems. Sentinel surveillance will help monitor viral circulation, introduction of new serotypes, vector presence and behavior, and characterization of patients with serious forms of the disease, among other aspects. Furthermore, the generic protocol for integrated epidemiological surveillance of dengue, chikungunya, and Zika will become a tool to facilitate the comparison of data between countries and to improve the design of prevention and control actions.

Table 4-4. Results, indicators, sources, assumptions, and risks: epidemiology component

Results	Indicators	Verification sources	Assumptions/Risks
R1 Having an integrated epidemiological surveillance system for arboviruses that optimizes information analysis to improve decision-making, with a view to having an impact on prevention and control activities	Number of countries implementing the integrated arbovirus surveillance system/ Total number of countries in the Region Number of countries conducting an integrated analysis of arboviruses/ Total number of countries with integrated surveillance systems Number of countries that make decisions using the generated information in the integrated system/ Total number of countries that have integrated surveillance systems	Periodic country reports Periodic country reports for the Region Health Information Platform for the Americas (PLISA) Report on external evaluations of the integrated arbovirus surveillance system in the countries	A standard regional protocol is accompanied by relevant instruments and routines for integrated arbovirus surveillance There is an up-to-date standard for arbovirus surveillance in the countries, consistent with the regional protocol It is compulsory to report arboviruses in the countries of the Region

Table 4-5. Results and activities: epidemiology component

Results	Activities
R1 Having an integrated epidemiological surveillance system for arboviruses that optimizes information analysis to improve decision-making, with a view to having an impact on prevention and control activities	**R1A1** Situation assessment of arboviral disease surveillance systems in the countries
	R1A2 Implementation of a single, standardized, integrated arbovirus surveillance system
	R1A3 Monitoring and evaluation of implementation of the epidemiological surveillance system for arboviral diseases
	R1A4 Analysis of information on the epidemiological risk of arboviral disease outbreak

Table 4-6. Activities, tasks, time frames, and responsible institution or persons: epidemiology component

Activities	Tasks	Time frame*			Responsible institution / person	Observations
		S	M	L		
R1A1 Situation assessment of arboviral disease surveillance systems in the countries	1. Preparation of methodological guidelines for the situation assessment of the arboviral disease surveillance systems	X			International GT-Arbovirus and PAHO	Creation of international GT-Arbovirus
	2. Inventory of arboviral disease surveillance systems	X			PAHO and national GT-Arbovirus	Information subsystems include laboratory, epidemiology, integrated vector management (entomological surveillance/ control), health services, and health promotion
	3. Preparation of a regional proposal for the integration of the surveillance information subsystems	X			PAHO and international GT-Arbovirus	Based on the results of the inventory and on evaluation of the technological capacity for integration
	4. Approval of the proposal by countries	X			Ministries of Health, coordinator of the national GT-Arbovirus, steering group of the national IMS-arbovirus, with support from PAHO country office	Approved by the highest health authority in the country
R1A2 Implementation of a single, standardized, integrated arbovirus surveillance system	1. Preparation of the generic protocol for integrated epidemiological surveillance of arboviral diseases in the Americas	X			International GT-Arbovirus and PAHO	Adaptation of the generic dengue protocol to arboviral diseases, which will include surveillance of pregnant women and of other complications of arboviral disease Approved by the member countries
	2. Management of resources to implement and maintain integrated surveillance systems	X	X	X	PAHO and Ministry of Health	Identifies the human resources and equipment needed to implement the integrated system

Activities	Tasks	Time frame*			Responsible institution / person	Observations
		S	M	L		
	3. Implementation and maintenance of the surveillance system based on the generic protocol for integrated epidemiological surveillance of arboviral diseases in the Americas, adjusted to the situation in each country	X	X	X	National GT-Arbovirus with support from PAHO	When preparing the situation assessment of the existing subsystems and of the protocols and integration tools, the aim is to identify a methodology that harmonizes the integration of the arbovirus information system
	4. Staff training with emphasis on the integrated analysis of the arboviral diseases	X	X	X	International and national GT-Arbovirus with support from PAHO	
	5. Preparation of reports based on standardized indicators that facilitate the comparison within the country (provinces, states, departments, etc.) and among the countries of the Region	X	X	X	National GT-Arbovirus and PAHO	The countries use the Health Information Platform for the Americas (PLISA) to report weekly epidemiological information on arboviral diseases The countries prepare national reports and PAHO prepares regional reports
R1A3 Monitoring and evaluation of implementation of the epidemiological surveillance system for arboviral diseases	1. Establish indicators for evaluating the quality and timeliness of information reported to the integrated epidemiological surveillance system for arboviral diseases	X			National GT-Arbovirus with support from the international GT-Arbovirus and PAHO	The reports consolidate the information from all subsystems for the preparation of an integrated report and analysis Health workers develop capacity to analyze existing information for timely decision-making

Activities	Tasks	Time frame*			Responsible institution / person	Observations
		S	M	L		
	2. Monitoring the operation of the surveillance system through integrated analysis	X	X	X	National GT-Arbovirus with support from the international GT-Arbovirus and PAHO	Verifies the operation of the integrated surveillance system
	3. Preparation of at least two operations research activities a year, with a view to evaluating national or regional surveillance systems, including product evaluations	X	X	X	National GT-Arbovirus with support from the international GT-Arbovirus and PAHO	National team collaborates with evidence-based operations research
	4. Feedback to contributing subsystems	X	X	X	National GT-Arbovirus	Ensures the sustainability and usefulness of the integrated system
R1A4 Analysis of the information on the epidemiological risk of arboviral disease outbreak	1. Updating the epidemiological situation room to analyze the risk of arboviral disease outbreaks	X	X	X	General Directorate of Epidemiology and PAHO	In the situation room, risk would be assessed using all components of standardized instruments for the Region
	2. Preparation of timely epidemiological alerts	X	X	X	General Directorate of Epidemiology and PAHO	Consistent with the International Health Regulations (IHR-2005)
	3. Work with the national GT-Arbovirus and the steering group of the national IMS-Arbovirus to adapt the information in existing communications plans (routine, risk, and crisis communication)	X	X	X	General Directorate of Epidemiology, IMS-arbovirus coordinator, national GT-Arbovirus, and steering group of the national IMS-Arbovirus, with support from PAHO	Depending on the magnitude of the outbreak or epidemic, the risk and/or crisis communications plan is activated The team receives training in communication

Activities	Tasks	Time frame*			Responsible institution / person	Observations
		S	M	L		
R1A4 Analysis of the information on the epidemiological risk of arboviral disease outbreak	4. Provision of information and guidance to the respective entities (political and technical levels, and general population)	X	X	X	Ministry of Health, IMS-arbovirus coordinator, national GT-Arbovirus, steering group of the national IMS-arbovirus, and groups or individuals responsible for communication in the Ministry of Health	For example, to other sectors beyond health, the news media, etc.
	5. Activation of the risk communication plan in response to an outbreak or epidemic in the Region	X	X	X	Ministry of Health with support from the IMS-arbovirus coordinator, steering group of the national IMS-arbovirus, and national GT-Arbovirus with support from PAHO	
	6. Monitoring and evaluation of interventions, and impact assessment	X	X	X	Ministry of Health, IMS-arbovirus, GT-Arbovirus coordinator, with support from PAHO	

*Time frame: S=short-term (1 year), M=medium-term (2-4 years), L=long-term (5+ years)

4.4 Patient care component

Dengue is the most widespread mosquito-borne viral disease in the Americas and the one most frequently suspected in febrile patients. However, the recent introduction of two new arboviruses (CHIKV in late 2013 and ZIKV in 2015) has created a new challenge for public health in the Americas. These three arboviral diseases (dengue, chikungunya, and Zika virus disease) occur epidemically and have similar clinical manifestations, causing an illness that may be mainly febrile (dengue, chikungunya) or exanthematous (Zika). Other common symptoms are headache and body ache, including myalgia and joint manifestations, or they can cause joint pain (dengue), arthritis (chikungunya), or both (Zika). Edema of the extremities (chikungunya and Zika) and non-purulent conjunctivitis (Zika) may also occur. It is important to bear in mind that infection with any of these arboviruses may be asymptomatic or oligosymptomatic (60-80%) and that they may even occur simultaneously with other infections, further hindering differential diagnosis.

In dengue virus (DENV) infections, the identification of warning signs, nearly always during or after the fever dissipates, aids in clinical diagnosis and helps to categorize the severity of the illness and decide on proper patient care. In the vast majority of cases arboviral diseases are self-limiting, but they can

occasionally take severe forms, causing shock, hemorrhage (in mucus or organs), or serious organ damage that can lead to death. Chikungunya virus (CHIKV) infections can also be clinically severe. However, chikungunya patients can also develop post-acute or chronic joint disease lasting 21 to 90 days or from three months to more than two years, respectively; these sequelae can be incapacitating. Any of these three arboviral diseases can lead to autoimmune disease of the central nervous system (Guillain-Barré syndrome, encephalopathy, or other conditions) and visual impairment from optic neuritis. To date, ZIKV seems to be the only virus capable of producing congenital malformations, such as microcephaly.

The manifestations of these arboviral diseases are complex. Thus, IMS-Arbovirus includes contains key aspects aimed at improving clinical diagnosis and timely case management, early detection of warning signs of suspected dengue (mainly by personnel at the first and second level of care), and a well-managed first-line response. All this is critical for obtaining good clinical outcomes and reducing the number of unnecessary hospitalizations and progression to severe cases of these arboviral diseases. An important aspect of IMS-Arbovirus is training health workers to identify patients with severe arboviral disease, with emphasis on the third level of care (hospital care). When planning the frequency of these training activities, consideration should be given to such factors as staff turnover and recently graduated physician cohorts in order to ensure their ability to make the diagnoses. Timely management of arbovirus sequelae (chikungunya and Zika virus) is included in the training that health professionals should receive, with a view to improving patient care and facilitating the rehabilitation process.

IMS-Arbovirus contains communication strategies targeting the general public within the framework of health promotion in order to disseminate clear messages on prevention, seeking immediate care, and recognizing the warning signs of suspected dengue. These messages will encourage the population to visit health centers for timely, comprehensive medical care, which not only includes clinical management of the patient, but also allows health workers to offer recommendations on vector control to the family and community.

IMS-arbovirus seeks to develop lines of operations research to improve policies, interventions, and strategies for patient care in order to facilitate the characterization of severe cases and deaths from these diseases. It also seeks to strengthen research on the physiopathology of arboviral diseases in pregnant patients and newborns.

The goal is to reduce case-fatality from dengue, chikungunya, and Zika virus through these actions:

- Improve clinical and differential diagnosis for timely management of severe dengue, chikungunya, and Zika virus cases in order to prevent deaths from arboviral diseases;
- Boost the response capacity of primary and secondary services to reduce hospital overcrowding, which often impedes proper management of seriously ill patients;
- Improve the organization or reorganization of health services during outbreaks and epidemics, keeping up-to-date contingency plans in endemic countries and implementing these plans to prevent deaths from these diseases;
- Develop and strengthen the capacities of health care personnel and establish quality assurance in both public and private health services;
- Prepare and implement science-based training materials, maintaining a continuous education plan;

- Within one week of a death, conduct an investigation (including autopsy information) to establish the primary cause of death and be able to identify circumstances and aspects of medical care that could be corrected or to which technical/administrative measures could apply, in accordance with each country's laws.

There are currently no biomarkers for predicting which patients are likely to develop severe disease. However, more detailed information can be collected through integrated epidemiological surveillance using the sentinel site modality. It is often difficult to make a differential clinical diagnosis among arboviral diseases, which makes it necessary to conduct operations research to clinically characterize these diseases, based on reliable laboratory evidence.

Table 4-7. Results, indicators, sources, assumptions, and risks: patient care component

Results	Indicators	Verification sources	Assumptions/Risks
R1 Improvement in the quality of clinical diagnosis, differential diagnosis, and integrated case management of suspected dengue, chikungunya, Zika, and other arboviral diseases in the Americas	Number of physicians trained in clinical diagnosis, differential diagnosis, and integrated case management of suspected dengue, chikungunya, Zika, or other arboviral diseases/ Total number of physicians in training plan Number of nurses trained in integrated case management of suspected dengue, chikungunya, Zika, or other arboviral diseases/ Total number of nurses in training plan Number of trained physicians and nurses who correctly follow the guidelines and protocols for case management of suspected dengue, chikungunya, Zika, and other arboviral diseases/ Total number of trained physicians and nurses Number of public and private health facilities that correctly follow the guidelines and flow charts for patient care/ Total number of health facilities in the country Number of public health facilities that have and implement contingency plans/ Total number of public health facilities in the country Case-fatality rate for each arboviral disease	Registry of trained physicians Registry of trained nurses Results of the evaluations of trained personnel, based on audit reports on the quality of patient care and death audits Death records Registry of health facilities that follow the guidelines and flow charts for patient care Updated records on implementation of the contingency plan in the health services Case records of units that treat the complications and sequelae of arboviral diseases Epidemiological bulletins based on data	Health workers lack the interest or commitment to participate in trainings Training program has guidelines and protocols for evaluating adherence Job security of personnel Frequent turnover in health staff Commitment of managers in public and private health facilities Sufficient supply of human, material, and financial resources Existence and availability of updated guidelines for the care of patients with suspected arboviral disease, and contingency plans for arboviral disease outbreaks or epidemics Financing and structure available for integrated care of patients with sequelae or complications of arboviral disease Lack of information on: trained physicians and nurses, deaths from dengue, units with

Results	Indicators	Verification sources	Assumptions/Risks
		from surveillance systems	contingency plans, medical units with capacity to treat severe cases of arboviral disease

Table 4-8. Results and activities: patient care component

Results	Activities
R1 Improvement in the quality of clinical diagnosis, differential diagnosis, and integrated case management of suspected dengue, chikungunya, Zika, and other arboviral diseases in the Americas	**R1A1** Timely and comprehensive management and proper monitoring of patients with suspected dengue, chikungunya, Zika and other arboviral diseases, based on the care guidelines and flow charts recommended by PAHO/WHO
	R1A2 Preparation of health worker training modules containing the patient-care component of IMS-arbovirus, and the patient and community education component
	R1A3 Reorganization of health services at the different levels of patient care during outbreaks/epidemics
	R1A4 Achieving integration between epidemiological/laboratory surveillance and patient care; improving the final classification of deaths in cases of suspected dengue, chikungunya, Zika, and other arboviral diseases
	R1A5 Development of lines of research to improve policies, interventions, and strategies for the clinical care of patients with suspected dengue, chikungunya, Zika, and other arboviral diseases

Table 4-9. Activities, tasks, time frames, and responsible institution or person: patient care component

Activities	Tasks	Time frame*			Responsible institution / person	Observations
		S	M	L		
R1A1 Timely and comprehensive management and proper monitoring of patients with suspected dengue, chikungunya, Zika and other arboviral diseases, based on the care guidelines and flow charts recommended by PAHO/WHO	1. Adapt national guidelines, based on updated PAHO/WHO recommendations (Dengue guidelines for patient care, 2nd edition; Tool for the diagnosis and care of patients with suspected arboviral diseases; and Clinical arboviral diseases guidelines for patient care, 1st edition)	X	X	X	Ministry of Health at the national and subnational level, national GT-Arbovirus with support from the international GT-Arbovirus and PAHO	These guidelines include the management of severe cases and special conditions (pregnant women, newborns, older adults, comorbidities)
	2. Promote timely, quality reporting of clinical and laboratory information on cases of suspected dengue, chikungunya, Zika, and other arboviral diseases (following care guidelines and flow charts recommended by PAHO/WHO) by health care workers to the surveillance system	X	X	X	Epidemiological surveillance directors and managers in medical care units at the primary, secondary, and tertiary levels	
R1A1 Timely and comprehensive management and proper monitoring of patients with suspected dengue, chikungunya, Zika and other arboviral diseases, based on the care guidelines and flow charts	3. Develop and promote the use of comprehensive online clinical courses to facilitate the continuous training of available health workers in the different countries	X	X	X	PAHO, with support from the international GT-Arbovirus	Based on the prepared guidelines
	4. Provide training in screening, clinical diagnosis, and timely management, primarily for health personnel at all levels of care	X	X	X	PAHO at the sub-regional level, countries and Ministry of Health at the national and subnational levels, all with support from the international and national GT-Arbovirus	

Activities	Tasks	Time frame*			Responsible institution / person	Observations
		S	M	L		
recommended by PAHO/WHO	5. Strengthen the clinical laboratory network to accompany case management of suspected dengue, chikungunya, Zika, and other arboviral disease	X	X	X	Health ministries, with support from PAHO	Examinations are essential for proper case management
	6. Evaluate the quality of care provided to patients with suspected dengue, chikungunya, Zika, or other arboviral diseases, including severe cases and deaths	X	X	X	Health ministries, case review committees in medical care units at all levels, national and international GT-Arbovirus, and PAHO	This evaluation should be carried out by the local, national, and international committees
	7. Guarantee the distribution and implementation of guidelines, including the development of new technologies (applications for mobile devices) to allow easy access to the guidelines	X	X	X	Health ministries, National GT-Arbovirus, with support from the international GT-Arbovirus and PAHO	
R1A2 Preparation of health worker training modules containing the patient-care component of IMS-arbovirus, and the patient and community education component	1. Review and standardize the case definition and the diagnostic and clinical laboratory criteria for severe cases caused by other arboviruses, as currently exist for dengue	X	X	X	PAHO, health ministries, and the international and national GT-Arbovirus	Based on operations research to clinically characterize laboratory-confirmed cases
	2. Dissemination and distribution of the contents of training modules	X	X	X	PAHO and health ministries	
	3. Include or strengthen undergraduate and graduate education curricula for health professionals on the subject of dengue, chikungunya, Zika, and other arboviral diseases	X	X	X	Health and education ministries at the regional, national, and local level	Prioritize subjects according to local epidemiology

Activities	Tasks	Time frame*			Responsible institution / person	Observations
		S	M	L		
R1A2 Preparation of health worker training modules containing the patient-care component of IMS-arbovirus, and the patient and community education component	4. Train physicians and other health professionals in communications for clear messaging to the population on prevention, immediate treatment and management of warning signs of dengue, and severe manifestations of dengue, chikungunya, Zika, and other arboviral diseases, according to the clinical phase of each disease	X	X	X	Groups or individuals responsible for communication in the Ministry of Health and international and national GT-Arbovirus, with support from PAHO	This involves how to prepare to health workers to give key messages in the mass media
R1A3 Reorganization of health services at the different levels of patient care during outbreaks/epidemics	1. Train health facility managers in health service management and organization	X	X	X	Ministry of Health, coordinator of the IMS-arbovirus and National GT-Arbovirus, with support from PAHO	Involve the local and regional health authorities
	2. Organize the screening, patient flow, clinical monitoring, and hospitalization areas in every institution, by level of care	X	X		Directors of health units	
	3. Maintain adequate integrated vector control in health institutions at all levels	X	X	X	Directors of health and vector control units	
	4. Annually review and adjust hospital contingency plan	X	X	X	Ministry of Health, directors of health units and national GT-Arbovirus	

Activities	Tasks	Time frame*			Responsible institution / person	Observations
		S	M	L		
	5. Continuous training workshops for public and private health personnel on the organization of health services, including outbreak response	X	X	X	PAHO and health ministries, with support from the international and national GT-Arbovirus at regional, national, and local levels	PAHO will be responsible for regional training. Health ministries will be responsible for national training
R1A4 Achieving integration between epidemiological/laboratory surveillance and patient care; improving the final classification of deaths in cases of suspected dengue, chikungunya, Zika, and other arboviral diseases	1. Strengthen systems for sending specimens, accompanied by all requested clinical information, on patients, severe cases, deaths, and pregnant women with suspected dengue, chikungunya, Zika, or other arboviral diseases	X	X		Directors of primary, secondary, and tertiary care units	This plays an important role in ensuring that the case is properly classified in the medical unit
	2. Prepare or improve guidelines and protocols for post-mortem research and diagnosis of cases with suspected dengue, chikungunya, Zika, and other arboviral diseases	X	X		Ministry of Health at the national level, with support from GT-Arbovirus and PAHO	
	3. Create a commission for the review of suspected deaths from dengue, chikungunya, Zika, and other arboviral diseases, at the local, regional, and national level	X	X	X	Ministry of Health at all levels	Consisting of: clinical physicians, laboratory personnel, epidemiologists, pathologists
R1A5 Development of lines of research to improve policies, interventions, and	1. Include academia (universities, institutes) in clinical research activities	X	X	X	PAHO, Ministry of Health, international and national GT-Arbovirus	

Activities	Tasks	Time frame*			Responsible institution / person	Observations
		S	M	L		
strategies for the clinical care of patients with suspected dengue, chikungunya, Zika, and other arboviral diseases	2. Clinically characterize patients with dengue, chikungunya, Zika, and other arboviral diseases based on reliable laboratory evidence that supports the differential diagnosis	X	X	X	PAHO, health ministries, international and national GT-Arbovirus, with support from academia	Characterize all cases (mild, moderate, severe)
	3. Use existing and available databases to generate the information needed to improve health policies, interventions, and strategies	X	X		Ministry of Health and academia	
	4. Strengthen research on the physiopathology of arboviral diseases	X	X	X	Academia and health ministries	

*Time frame: S=short-term (1 year), M=medium-term (2-4 years), L=long-term (5+ years)

4.5 Laboratory component

Laboratories play a key role in generating timely and quality information for decision-making on integrated epidemiological surveillance, through the serological and molecular diagnosis of circulating arboviruses. IMS-arbovirus strategically strengthens the national reference laboratories (NRLs) with support from PAHO/WHO collaborating centers (WHOCCs) for arbovirus diagnosis and centers of excellence, facilitating the exchange and transfer of technology throughout the Americas. In this regard, priority is given to strengthening national laboratories and their internal networks, with particular attention to quality management systems aimed at ensuring proper laboratory surveillance, while promoting the harmonization of diagnostic algorithms and case classification of circulating arboviruses (DENV, CHIKV, and ZIKV, among others).

Table 4-10. Results, indicators, sources, assumptions, and risks: laboratory component

Results	Indicators	Verification sources	Assumptions/ Risks
R1 Timely, reliable, quality information generated by laboratories for decision-making on arboviral disease surveillance, prevention, and control	Number of national reference laboratories or laboratories designated by the national authorities that are RELDA members/ Number of national reference laboratories or laboratories designated by the national authorities Number of national reference laboratories or laboratories designated by the national authorities with an established quality management system/ Number of national reference laboratories or laboratories designated by the national authorities Number of national reference laboratories or laboratories designated by the national authorities with algorithms and protocols aligned with the laboratory diagnosis manual in the context of PAHO IMS-arbovirus/ Number of national reference laboratories or designated laboratories Number of national reference laboratories or laboratories designated by the national authorities with installed platforms for serological diagnosis/ Number of national reference laboratories or designated laboratories Number of national reference laboratories or laboratories designated by the national authorities with installed platforms for molecular diagnosis/ Number of national reference laboratories or designated laboratories Number of national reference laboratories or laboratories designated by the national authorities with capacity for diagnosing and monitoring DENV, CHIKV, and ZIKV/ Number of national reference laboratories or designated laboratories Number of national reference laboratories or laboratories designated by the national authorities with capacity for detection of yellow fever virus (YFV)/ Number of national reference laboratories or designated laboratories	RELDA annual reports and website Epidemiological bulletins and laboratory reports RELDA report on the survey of capacities of member laboratories in the network System manual on institutional quality management Manual on standard laboratory operating procedures External evaluation report on the quality of national laboratories National laboratory human resources training plan (reference laboratories or laboratories designated by the national authorities for arbovirus diagnosis and surveillance) and RELDA Laboratory contingency plan for epidemics	Commitment of authorities High turnover of skilled workers Availability of economic resources Capacity to procure and distribute critical reagents Country regulations on imports and exports of biologicals

The Arbovirus Diagnosis Laboratory Network (RELDA) ensures the operation of the laboratory component of IMS-arbovirus. RELDA was created in 2008 to strengthen the scientific and technical capacities of the Region's national laboratories and to establish a standard protocol for the diagnosis of dengue and other arboviruses.

RELDA will support the implementation of a sustainable training plan that includes serological and molecular diagnosis, biosafety, good laboratory practices, and technology transfer, to increase the number of laboratories capable of producing reagents of the necessary quality for arbovirus diagnosis.

IMS-arbovirus will make it possible to evaluate all RELDA member laboratories, as well as laboratories with quality management policies and standard protocols. The PAHO/WHO website has a RELDA page with key information on each center and laboratory, structures, resources, technical expertise, and research projects to make updated information accessible to every country and territory.

Table 4-11. Results and activities: laboratory component

Results	Activities
R1 Timely, reliable, quality information generated by laboratories for decision-making on arboviral disease surveillance, prevention, and control	**R1A1** Strengthen the response capacity of national laboratories and their networks
	R1A2 Ensure the flow of information from the national laboratories and their networks to the different health system stakeholders and IMS-arbovirus components
	R1A3 Harmonize regional algorithms and protocols for arboviral disease detection and surveillance with PAHO technical guidance on arbovirus diagnosis
	R1A4 Strengthen quality management system processes
	R1A5 Establish priority lines of operations research to strengthen both the diagnosis and integrated epidemiological surveillance of arboviral diseases

Table 4-12. Activities, tasks, time frames, and responsible institution or person: laboratory component

Activities	Tasks	Time frame*			Responsible institution / person	Observations
		S	M	L		
R1A1 Strengthen the response capacity of national laboratories and their networks	1. Prepare and disseminate technical guidance on arbovirus diagnosis	X			PAHO, PAHO/WHO collaborating centers, RELDA, centers of excellence and national reference laboratories of the health ministries	

Activities	Tasks	Time frame*			Responsible institution / person	Observations
		S	M	L		
R1A1 Strengthen the response capacity of national laboratories and their networks	2. Develop a sustainable training plan that includes serological, molecular, and virologic diagnosis, biosafety, good laboratory practices, sequencing and analysis, and phylogenetic analysis	X	X	X	PAHO, RELDA PAHO/WHO collaborating centers health ministries, international and national GT-Arbovirus	
	3. Transfer technology to increase the number of laboratories with in-house capacity to produce reagents of the necessary quality for the diagnosis of arboviral diseases	X	X	X	RELDA, PAHO/WHO collaborating centers and centers of excellence, health ministries	
	4. Identify collaborating centers and centers of excellence to prepare and store an essential minimum volume of biologicals for immediate distribution to the countries in emergencies	X	X	X	PAHO, RELDA, PAHO/WHO collaborating centers and centers of excellence, health ministries	
	5. Increase the capacity for viral detection in mosquitoes in the entomo-virologic surveillance network.	X	X	X	PAHO/WHO collaborating centers and centers of excellence, national reference laboratories or laboratories designated by the national authorities for arbovirus diagnosis and surveillance, vector control programs, and national GT-Arbovirus	Close collaboration with the Integrated Vector Management (IVM) component
	6. Transfer new diagnostic technologies based on availability and epidemiological situation	X	X	X	RELDA, PAHO, PAHO/WHO collaborating centers and centers of excellence, Ministry of Health	New protocols/ platforms
	7. Develop a model laboratory contingency plan for epidemics		X		PAHO, RELDA, Ministry of Health, and National GT-Arbovirus	Guidelines of the contingency plan (annex)

Activities	Tasks	Time frame*			Responsible institution / person	Observations
		S	M	L		
	8. Strengthen national laboratory networks for diagnosis and surveillance through decentralization	X	X	X	PAHO, health ministries, national reference laboratories	
R1A2 Ensure the flow of information from the national laboratories and their networks to the different health system stakeholders and IMS-arbovirus components	1. Participate in the drafting of national protocols for integrated epidemiological surveillance	X	X	X	Coordinator of the IMS-arbovirus, national reference laboratories or laboratories designated by the national authorities for arbovirus diagnosis and surveillance, departments of epidemiological surveillance	
	2. Participate in periodic IMS-arbovirus monitoring meetings	X	X	X	IMS-arbovirus coordinator, national reference laboratories or laboratories designated by the national authorities for arbovirus diagnosis and surveillance, and other components of IMS-arbovirus	
	3. Integrate case and laboratory surveillance information systems to guarantee the flow and availability of information at different national levels		X	X	PAHO, national reference laboratories or laboratories designated by the national authorities for arbovirus diagnosis and surveillance, and epidemiological surveillance departments of the health ministries	
	4. Create a system for collecting regional virologic data and information	X	X	X	PAHO, RELDA, international GT-Arbovirus	Integrated surveillance system includes laboratory indicators
	5. Periodically update the RELDA website	X	X	X	PAHO, RELDA coordinator	
	6. Participate in annual meetings of RELDA	X	X	X	PAHO and RELDA laboratories	

Activities	Tasks	Time frame*			Responsible institution / person	Observations
		S	M	L		
R1A3 Harmonize regional algorithms and protocols for arboviral disease detection and surveillance with PAHO technical guidance on arbovirus diagnosis	1. Prepare, update, and disseminate protocols and algorithms for the detection and diagnosis of arboviral diseases, based on the national, regional, and global epidemiological situation	X	X	X	PAHO, national reference laboratories or laboratories designated by the national authorities for arbovirus diagnosis and surveillance, RELDA, PAHO/WHO collaborating centers, international GT-Arbovirus	
	2. Prepare protocols and guidelines for the evaluation of diagnostic methodologies		X	X	PAHO, national laboratories (of reference or designated by the national authorities for arboviral diagnosis and surveillance)	
	3. Evaluation current diagnostic algorithms		X	X	PAHO, RELDA, international GT-Arbovirus	
R1A4 Strengthen quality management system processes	1. Implement quality management systems in laboratories		X	X	National reference laboratories or laboratories designated by the national authorities for arbovirus diagnosis and surveillance, PAHO/WHO collaborating centers, RELDA	
	2. Conduct visits to review and evaluate quality assurance procedures associated with laboratory surveillance of arboviral diseases	X	X	X	PAHO/WHO collaborating centers, RELDA, national laboratories, international and national GT-Arbovirus	
	3. Organize external quality assurance (EQA) programs	X	X	X	PAHO/WHO collaborating centers, RELDA, national reference laboratories or laboratories designated by the national authorities for arbovirus diagnosis and surveillance	
	4. Participate in national and international external quality assurance (EQA) programs	X	X	X	PAHO/WHO collaborating centers, RELDA, national reference laboratories or laboratories designated by the national authorities for arbovirus diagnosis and surveillance, international and national GT-Arbovirus	

Activities	Tasks	Time frame*			Responsible institution / person	Observations
		S	M	L		
R1A5 Establish priority lines of operations research to strengthen both the diagnosis and integrated epidemiological surveillance of arboviral diseases	1. Multicenter evaluations of commercial kits (including rapid tests)	X	X	X	PAHO/WHO collaborating centers, RELDA	To submit proposals for small grants and subsidies
	2. Evaluate the usefulness of different biological specimens, viral kinetics, and prognostic markers	X	X	X	PAHO/WHO collaborating centers, RELDA, , national reference laboratories or laboratories designated by the national authorities for arbovirus diagnosis and surveillance	
	3. Develop and evaluate new serological tools	X	X	X	PAHO/WHO collaborating centers, RELDA	
	4. Evaluate viral detection in mosquitoes as an entomo-virologic indicator within comprehensive epidemiological surveillance	X	X	X	PAHO/WHO collaborating centers, RELDA, national reference laboratories or laboratories designated by the national authorities for arbovirus diagnosis and surveillance	In coordination with the integrated vector management and epidemiology components
R1A5 Establish priority lines of operations research to strengthen both the diagnosis and integrated epidemiological surveillance of arboviral diseases	5. Implementation strategies for arboviral genomic surveillance	X	X	X	PAHO/WHO collaborating centers, RELDA, national reference laboratories or laboratories designated by the national authorities for arbovirus diagnosis and surveillance	VIGENDA: Project for genomic monitoring of dengue virus in the Americas

*Time frame: S=short-term (1 year), M=medium-term (2-4 years), L=long-term (5+ years)

4.6 Integrated vector management component

Integrated vector management (IVM) is a rational decision-making process to optimize the use of resources in entomological surveillance and vector control. For this reason, its structure includes the appropriate management of available resources (human, logistic, and methodological, among others) for planned, sustainable technical coordination of actions in vector control programs. These interventions are

strengthened by integrating various control, surveillance, communication, and community participation methodologies, and by the participation of other sectors beyond the health sector.

Within the framework of IMS-arbovirus, IVM includes the following processes:

- Contribution of entomological surveillance results to ensure evaluation of entomological risks and transmission dynamics based on integrated entomological surveillance (i.e., a system that considers data from epidemiological, laboratory, entomological, environmental, and clinical sources, among others, analyzed in the context of IMS-arbovirus), factors that favor vector proliferation and dispersion, and vectoral capacity;

- Selection of internationally validated and accepted vector prevention and control methods that are based on the best available evidence on the biology of the vector, the environment, and the transmission and morbidity of the disease;

- Utilization of multiple types of interventions, with defined frequency and coverage, in synergistic and synchronized combination;

- Interaction of the health sector with other public and private sectors related to environmental management, education, nongovernmental organizations (NGOs), tourism, and agriculture, among others whose work has an impact on preventing and reducing the risk of vector-borne transmission;

- Integration, in terms of shared responsibility of individuals, families, and communities to strengthen and ensure the sustainability of vector surveillance and control processes at the local level;

- Establishment of a legal framework that permits the implementation of IVM as a theoretical and practical model that can help to control arboviral diseases.

Despite the efforts that countries have made to develop and implement IMS-dengue, and due to various factors, the adoption and development of entomological surveillance and vector control, along with the other components, has not been sufficient to stop the transmission of dengue and other arboviruses. As a result, IMS-arbovirus seeks to strengthen the operationality of IVM through the methodological standardization of entomological surveillance strategies and vector prevention and control activities, both between epidemics and during outbreaks and epidemics. IMS-arbovirus is a methodological tool that enables countries to consolidate interactions between the components of national control programs and other sectors (education, environment, NGO, public, private, etc.) strengthening entomological surveillance and vector prevention and control, based on IVM.

It is equally important to consider that IMS-arbovirus proposes operations research as a way to acquire basic operational knowledge to provide feedback for decision-making. This will permit timely, effective interventions and, in turn, can improve the tools used to measure the impact of these interventions. Furthermore, IVM helps to strengthen comprehensive entomological surveillance systems in which several indicators are monitored, such as resistance to insecticides and viral circulation in mosquitoes, among others. Countries can make use of existing capacities at PAHO/WHO collaborating centers to update their records on the vectors' response to the insecticides used in control activities, or to map sentinel areas of viral circulation in mosquitoes. In order to achieve this strengthening, it is essential to

provide workers with continuous training so that they have the technical and operational capacities to ensure the proper use of surveillance and control techniques, supervision, monitoring, and evaluation of entomological surveillance and vector control activities. Finally, community empowerment in the prevention and control of arboviral diseases can be achieved through behavioral impact, which is one of the key elements of IVM.

Table 4-13. Results, indicators, sources, assumptions, and risks: integrated vector management component

Results	Indicators	Verification sources	Assumptions/Risks
R1 Integrated arbovirus vector management implemented	Number of countries that have implemented an integrated entomological surveillance system/ Total number of countries Number of countries that have reviewed and updated manuals on entomological surveillance and vector control, based on IVM/ Total number of countries Number of countries with at least one interinstitutional agreement for IVM implementation/ Total number of countries Number of countries that have implemented a system for continuous training on entomological monitoring and vector control / Total number of countries	Periodic country reports Field evaluation by expert teams Published documents on IVM-based entomological surveillance and vector control Documents on interinstitutional agreements Documents on training activities held	Plan of Action on Entomology and Vector Control 2018-2023 implemented by countries Political acceptance by countries Sufficient technical and operational capacity Vector control programs structurally strengthened Operational entomological surveillance system

Table 4-14. Results and activities: integrated vector management component

Results	Activities
R1 Integrated arbovirus vector management implemented	**R1A1** Implement an integrated entomological surveillance system
	R1A2 Adjust transmission prevention and vector control strategies to new epidemiological and methodological scenarios in order to implement integrated, targeted, effective, and timely interventions

Table 4-15. Activities, tasks, time frames, and responsible institution or person: integrated vector management component

Activities	Tasks	Time frame*			Responsible institution / person	Observations
		S	M	L		
R1A1 Implement an integrated entomological surveillance system	1. Hold meetings with experts to: a. Define a set of indicators (eggs, larvae, pupae, and adults) in coordination with the epidemiology teams, for decision-making based on entomological monitoring b. Define, standardize, and prepare documents that describe the methodologies for integrated entomological monitoring of vectors within the framework of IMS-arbovirus c. Share entomological surveillance methodologies with the countries in order to operationalize them	X	X		PAHO, health ministries, international and national GT-Arbovirus, PAHO/WHO collaborating centers	It is important to include recommendations on the development of indicators to evaluate behavioral changes in the human beings; the academy should be invited these meetings
	2. Evaluate installed capacity and the need for entomological surveillance	X			Health ministries at the national and subnational level, national GT-Arbovirus	Design an evaluation of needs for the vector control
	3. Participate in a regional network for surveillance of insecticide resistance	X	X	X	PAHO, health ministries, international and national GT-Arbovirus, PAHO/WHO collaborating centers and academia	Articulation in existing networks Generate a comprehensive plan of surveillance and management of insecticide resistance
R1A1 Implement an integrated entomological surveillance system	4. Based on the results obtained in point 2 (above), implement a continuous training program on integrated entomological surveillance to strengthen programs and technical capacities at the managerial and operational levels	X	X	X	PAHO, health ministries, international and national GT-Arbovirus, PAHO/WHO collaborating centers, and academia	It is essential for countries to have the necessary human and technical resources to maintain this system National capacity-building plans should be aligned with the regional plan and be mutually supportive

Activities	Tasks	Time frame*			Responsible institution / person	Observations
		S	M	L		
	5. Participate in the entomo-virologic laboratory network of the Americas	X	X		PAHO, health ministries, international and national GT-Arbovirus, PAHO/WHO collaborating centers, and academia	Adapted to countries' needs, priorities, and interests Take advantage of existing installed capacities (RELDA) Make the PAHO guide available
	6. Promote operations research to guide decision-making on entomological surveillance actions and activities	X	X	X	PAHO, health ministries, international and national GT-Arbovirus, PAHO/WHO collaborating centers, and academia	Investigate improving/developing entomological indicators to better predict entomological risk Support the development of new technologies for entomological surveillance and vector control
R1A2 Adjust transmission prevention and vector control strategies to new epidemiological and methodological scenarios in order to implement integrated, targeted, effective, and timely interventions	1. Hold meetings with experts to: a. Refocus the use of vector control methods in alignment with PAHO's new operational guidelines b. Prepare documents that describe, standardize, and evaluate vector control methodologies c. Share vector control methodologies with the countries in order to operationalize them	X	X	X	PAHO, health ministries, international and national GT-Arbovirus, PAHO/WHO collaborating centers, and academia	Support pilot projects for implementation of the new operational model for *Aedes* control developed by PAHO This is a continuous process
	2. Evaluate vector control capacities and needs	X			National and subnational health ministries, national GT-Arbovirus	Should be linked to R1A1, task 2

Activities	Tasks	Time frame*			Responsible institution / person	Observations
		S	M	L		
R1A2 Adjust transmission prevention and vector control strategies to new epidemiological and methodological scenarios in order to implement integrated, targeted, effective, and timely interventions	3. Include a comprehensive plan for systematic evaluation of processes and impacts in national vector control programs	X	X	X	PAHO, Ministry of Health, international and national GT-Arbovirus, PAHO/WHO collaborating centers, and academia	Some guidelines on new technologies are available from the WHO Vector Control Advisory Group (VCAG-WHO), the PAHO Technical Advisory Group on Public Health Entomology (TAG-PHE), and national TAG-PHEs. All interventions (chemical, community, environmental, etc.) should be evaluated Evaluating the impact of control interventions is an important part of a vector control program
	4. Strengthen technical capacities for entomological surveillance and vector control at the managerial and operational level, through systematic training	X	X	X	PAHO, Ministry of Health, IMS-arbovirus coordinator, international and national GT-Arbovirus, PAHO/WHO collaborating centers, and academia	This activity is linked to the Regional Training Plan on Public Health Entomology and Vector Control that PAHO is preparing Workshops (theory and practice)
	5. Integrate IMS-arbovirus with other programs for the prevention and control of other disease vectors, within the IVM framework		X	X	Countries, health ministries, IMS-arbovirus coordinator	Integration should be expressed in concrete actions
	6. Promote basic and operations research to provide feedback for decision-making on vector control, including new technologies for control vector that are available and approved by PAHO/WHO	X	X	X	PAHO, health ministries, international and national GT-Arbovirus, PAHO/WHO collaborating centers, and academia	These research activities should be systematic, standardized, and preferably independent, following established protocols, guidelines, and specific indicators

Activities	Tasks	Time frame*			Responsible institution / person	Observations
		S	M	L		
R1A2 Adjust transmission prevention and vector control strategies to new epidemiological and methodological scenarios in order to implement integrated, targeted, effective, and timely interventions	7. Support the development of methodologies and/or tools that promote the empowerment of communities, families, and individuals in order to work together to improve transmission prevention and vector control	X	X	X	PAHO, health ministries, Dept. of Health Promotion and Communication, international and national GT-Arbovirus, PAHO/WHO collaborating centers, and academia	Health Promotion and Communication

*Time frame: S=short-term (1 year), M=medium-term (2-4 years), L=long-term (5+ years)

4.7 Environment component

The transmission of arboviral diseases depends on the presence of various social and environmental determinants. Prevention, control, and modification of these determinants is dependent not only on vector prevention and control programs within the health sector, but also on IMS-arbovirus and the WHO Global Strategy for 2012-2020, which emphasize an interprogrammatic, intersectoral, and interinstitutional approach for proper implementation within the framework of development agendas. It is also very important to create a legal framework to help reduce the most common breeding sites, which are created by construction, improper disposal of tires, barrels, water storage tanks, and other containers.

Several initiatives in the Region have led to laws that favor the elimination of breeding sites in countries such as Brazil, Costa Rica, El Salvador, Panama, and Paraguay. However, climate change, lack of proper solid waste collection, constant shortages that force people to store water, and uncontrolled urban development are some areas that require political attention at the highest level, as well as participation by all stakeholders, especially international cooperation.

With respect to eliminating breeding sites in homes, achieving behavioral change in families is an action that should not be postponed. This should be done within the framework of environmental sanitation activities carried out by local governments and it will require the participation of multidisciplinary teams that can investigate how to achieve the desired changes, taking into account the culture and special features of each place.

Interprogrammatic management means joint action by at least the following programs within the health sector: vector prevention and control, environmental health, risk management, and health promotion.

A plan means a set of actions that interprogrammatic management should implement in at least the following areas (see Figure 4-1):

1. Setting environmental targets associated with arboviral diseases (standards);
2. Analyzing the health risks associated with environmental determinants;
3. Including the health component in environmental impact assessments associated with infrastructure improvement projects;
4. Conducting research on the relationship between health and environment to support decision-making;
5. Developing capacities to strengthen human resources for health;
6. Using communication tools to achieve community commitment, for example, communication for behavioral impact (COMBI); these can be adapted by countries;
7. Forging partnerships with other relevant sectors to implement these actions.

These plans should promote people-centered local actions and they should be context-specific, comprehensive, multisectoral, focused on disease prevention and health promotion, and within a framework of protection and empowerment.

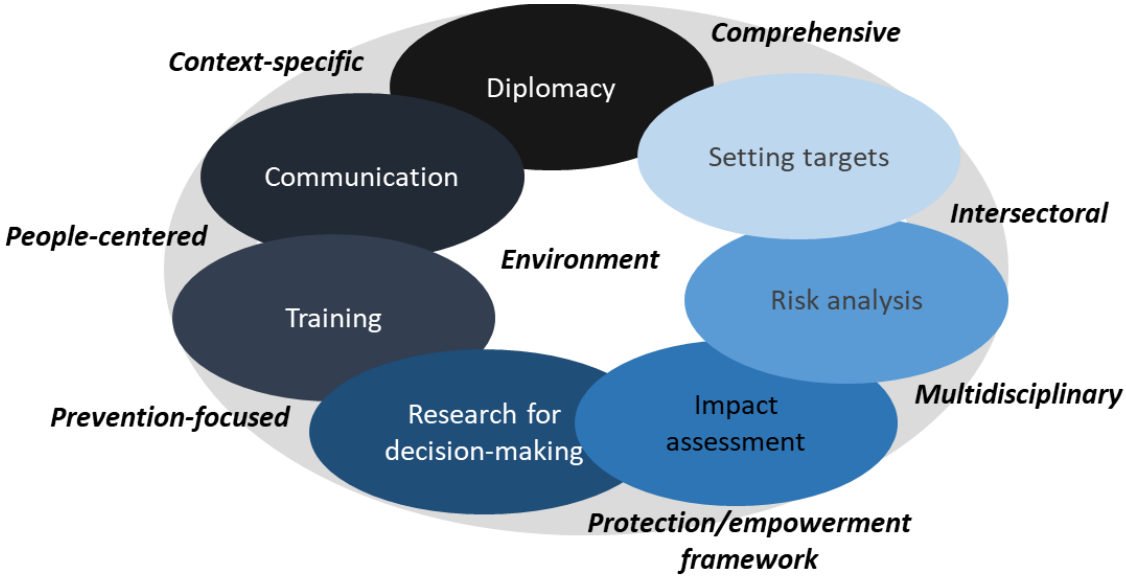

Figure 4-1. Areas of the interprogrammatic action plan

Table 4-16. Results, indicators, sources, assumptions, and risks: environment component

Results	Indicators	Verification sources	Assumptions/Risks
R1 Interprogrammatic action on the environment that helps to reduce the risk of arbovirus transmission	100% of countries have officially formed interprogrammatic management working groups by 2019 100% of countries are implementing interprogrammatic plans by 2020	Country reports (participating entities, management and compliance agreements) Interprogrammatic plans Monitoring and supervisory visits	Permanent political commitment at the highest level Actors that can influence environmental management and help reduce transmission risks participate actively in the working groups A legal framework for the environment and health is in implementation, as well as management agreements with stakeholder institutions

Table 4-17. Results and activities: environment component

Results	Activities
R1 Interprogrammatic action on the environment that helps to reduce the risk of arbovirus transmission	**R1A1** Form interprogrammatic groups at the national and subnational level
	R1A2 Develop and evaluate interprogrammatic plans that support environmental management in order to reduce the vector population and prevent arboviral diseases
	R1A3 Develop a regional project to demonstrate participatory research at the country level aimed at addressing the environmental determinants of arboviral diseases through strengthened community resilience
	R1A4 Facilitate the integration of transectoral groups made up of public- and private-sector actors involved in environmental management at the national and subnational level, according to the priorities in each country

Table 4-18. Activities, tasks, time frames, and responsible institution or persons: environment component

Activities	Tasks	Time frame*			Responsible institution / person	Observations
		S	M	L		
R1A1 Form interprogrammatic groups at the national and subnational level [1]	1. Build the profile of group members	X			Ministry of Health	
	2. Identify actors in health sector programs based on the defined profile, and establish the corresponding responsibilities for implementation in the respective spheres of activity	X			Ministry of Health	
R1A1 Form interprogrammatic groups at the national and subnational level	3. Institutionalize national and subnational interprogrammatic groups	X	X		Ministry of Health	
	4. Conduct training on implementation of actions by the groups formed	X	X		Ministry of Health with support from PAHO	Training would focus on environmental health risk assessment, management, and communication
R1A2 Develop and evaluate interprogrammatic plans that support environmental management in order to reduce the vector population and prevent arboviral diseases	1. Plan and implement interprogrammatic activities		X	X	Ministry of Health	
	2. Monitor and evaluate implementation of the plans		X	X	Ministry of Health	
	3. Evaluate the impact of the plans			X	Ministry of Health	
R1A3 Develop a regional project to demonstrate participatory research at the country level aimed at addressing the environmental determinants of	1. Identify the country and the public institution leading the project	X			Ministry of Health	
	2. Identify other actors who will participate in project implementation	X			Ministry of Health	
	3. Design, implement, monitor, and evaluate the project	X	X	X	Ministry of Health	

[1] The interprogrammatic group should consist of stakeholders in environmental issues, municipal programs, actors responsible for environmental management, and members of the IMS-Arbovirus steering group (epidemiology, patient care, IVM, and environment).

Activities	Tasks	Time frame*			Responsible institution / person	Observations
		S	M	L		
arboviral diseases through strengthened community resilience	4. Disseminate the lessons learned in order to establish a regional process to strengthen community resiliency			X	Ministry of Health	
R1A4 Facilitate the integration of transectoral groups made up of public- and private-sector actors involved in environmental management at the national and subnational level, according to the priorities in each country	1. Identify social actors and establish responsibilities for implementation in the respective areas of each country	X			Ministry of Health and Ministry of Environment	
	2. Determine whether or not there is an institution that coordinates environmental control measures	X			Ministry of Health and Ministry of Environment	

*Time frame: S=short-term (1 year), M=medium-term (2-4 years), L=long-term (5+ years)

4.8 Operations research and communication for behavioral impact

IMS-arbovirus includes a section devoted to operations research, an essential source of scientific evidence aimed at improving the quality of disease control and health programs and learning from them as they are scaled up. Many definitions of operations research have been proposed, but a pragmatic definition from the perspective of a health program would be: the search for knowledge about interventions, strategies, and tools that can improve a program's quality, effectiveness, and coverage.

Operations research provides those responsible for decision-making with information they can use to improve the performance of health programs. It also helps identify solutions to problems that limit a program's quality, efficiency, and effectiveness, and can help determine which alternative strategy for service delivery would yield the best results.

Operations research questions tend to focus on understanding the access barriers to a health program. Social and economic trials and studies can provide input on how to overcome these barriers and suggest effective interventions. The first step in operations research is to identify an adequate research question that can improve the operation of a health program.

Table 4-19. Main approaches: management component

Operations research question	Observations	Next steps
Establish evidence-based permanent improvement processes: • **Define the lines of operations research** based on an **initial diagnosis** according to the IMS-arbovirus component and the country • Establish the guidelines for the **call for operations research** projects • Prepare **generic** operations research **protocols** for the different components, taking into account bioethical aspects • Select research proposals	Priority Ensures that the operations research component is foundational and continuous (supporting the implementation of arbovirus programs, policies, and strategies)	Coordinate regional level with countries and corresponding collaborating centers (committee) Draft a concept note: - Rationale - Methodology - Budget - Schedule Locate funds

Table 4-20. Main approaches: epidemiology component

Operations research question	Observations	Next steps
Effectiveness of the epidemiological surveillance systems in regard to the quantitative and qualitative attributes of the new system	Clarify: Operations research vs routine monitoring Depends on the existence of an "integrated" system = medium term Evaluate system: determine criteria (adherence, flexibility, sensitivity) (CDC, 2001) Regional/country system Consider Mexico: lessons learned; results of advocacy (pilot)	Monitoring: regional and country level Locate funds
Operations research question	**Observations**	**Next steps**
Clinical characterization of confirmed cases of Zika virus disease, dengue, and chikungunya, and impact on case definition in the Region		
Adherence to the new surveillance protocols for health workers at the different levels		

The patient care component requires the development of lines of research to improve policies, interventions, and clinical care strategies for patients with suspected dengue, chikungunya, Zika, and other arboviral diseases.

Table 4-21. Main approaches: patient care component

Operations research question	Observations	Next steps
Clinical characterization of patients with dengue, chikungunya, Zika, and other arboviral diseases, based on reliable laboratory evidence that supports differential diagnosis	Priority: clinical standards Prospective and/or retrospective study Retrospective (severe cases, biases) Consider number of patients (type of health center that identifies patients) Where: active circulation of three arboviruses (Brazil, Colombia, El Salvador-multicentric, Paraguay) (principal investigators) Brazil prospective study (different geographical areas) Accessible laboratory confirmation (*gold standard*) Consider coinfection	Retrospective/ prospective study
NEW Characterization of the **causes of mortality** and risk factors for dengue/ chikungunya/ Zika	Retrospective study (to evaluate the possibility of real autopsy and verbal autopsy) Diagnostic quality: confirmed cases (PCR, histopathological) Countries: Brazil, Colombia, Cuba, Paraguay	Priority: locate financing and interested countries

The laboratory component requires establishing priority lines of operations research in order to strengthen both the diagnosis and surveillance of arboviral diseases.

Table 4-22. Main approaches: laboratory component

Operations research question	Observations	Next steps
Multicenter evaluations of commercial kits (including rapid tests)	Multicenter evaluation, geographical representation, institutions Build sub-regional panel Origin of samples (representation) Test selection criteria (e.g. trivalent) New tests to consider (Zika, dengue) Sequential methodology In second phase: - intra -country evaluation - need to build regional panels (phase 2)	Retrospective/ prospective
Evaluation of the usefulness of the different biological samples and **viral kinetics,** prognostic markers	Important to monitor by laboratory group	PAHO/WHO national laboratories (reference or designated by the national authorities for arboviral diagnosis and surveillance)
PAHO/WHO national laboratories (reference or designated by the national authorities for arboviral diagnosis and surveillance)	High priority Medium/long term	PAHO/WHO collaborating centers, RELDA
Evaluation of viral detection in mosquitoes as an entomo-virologic indicator within comprehensive surveillance	IVM + Laboratory + Epidemiology Case studies: Brazil (Espíritu Santo), Cuba, Mexico	PAHO/ RELDA/ RELEVA/ PAHO/ WHO, collaborating centers, national laboratories (reference or designated by the national authorities for arboviral diagnosis and surveillance)
Implementation of strategies for genomic arbovirus surveillance	Important: basic sciences	PAHO/WHO, collaborating centers, national laboratories (reference or designated by the national authorities for arboviral diagnosis and surveillance)

The integrated vector management component includes participation in operations research that guides decision-making on control interventions and new technologies for vector control.

Table 4-23. Integrated vector management component

Operations research question	Observations	Next steps
Is it possible to improve/find entomological indicators to predict entomological risk with greater certainty?	This has been needed for many years and it is a complicated problem. It is not expected that a single indicator can predict a risk situation; need to involve the biology chairs of universities	Regional monitoring with PAHO/WHO collaborating centers and countries
What control measures are most cost-effective?	Important: - Use already existing data (need for systematic review) - Begin with selection of one or two of the most commonly used techniques; e.g.: breeding site elimination, treating breeding sites and fumigation	Identify partners in the research process

Table 4-24. Environment component

Operations research question	Observations	Next steps
Develop regional project to demonstrate participatory research at the country level in order to address the environmental determinants of arboviral diseases by strengthening community resiliency	Define community resiliency Here, they are considered social determinants (not environmental determinants) Need to: - reformulate and focus more on environment - identify indicators - explain how results relate to IMS-arbovirus - consider a situation analysis in which communities propose interventions	

Communication for behavioral impact (COMBI) seeks, through communication, to change peoples' behavior with respect to arboviral disease prevention and alerts. Behavior change is a process in which people go through several stages of learning: information, growing awareness, and implementation of the proposed measures. It will be necessary to tailor each message (and how it is transmitted) to the context of the desired behavioral change.

4.9 Facilitating factors

The IMS-dengue operational model identified certain 'facilitating factors' as key elements for implementing the strategy. As the strategy was adapted, these elements were included, strongly impacting the progress made in each country. Based on these positive results, it was considered vitally important to include these factors in the IMS-arbovirus operational model. The facilitating factors are: advocacy, resource mobilization, partnerships, capacity building, and monitoring and evaluation.

A. **Advocacy:** This includes communication, dissemination, and persuasion at all levels to achieve the implementation of IMS-arbovirus. The advocacy process should involve the decision-making and management levels of the health sector and should reach beyond the health sector to include governmental, nongovernmental, national, and local levels, including the private sector.

B. **Resource mobilization:** It is essential to identify stakeholders (public and private, national and international) and raise their awareness through advocacy supported by timely, high-quality information. This will help obtain the resources needed to strengthen national capacity, prevent the appearance of arboviral diseases, and above all, respond to outbreaks and epidemics. One of the biggest problems facing these strategies is limited resources, which in most cases are insufficient to address the complex determinants of transmission. This means that adequate planning of resources (human, financial, and material) is required to address the complexity of IMS-arbovirus and ensure its sustainable implementation through time and space.

C. **Forging partnerships:** The technical complexity of the efforts required to combat arboviral diseases is so great that the health sector cannot by itself provide a timely, quality response. For an integrated response that involves all components of the strategy, strong partnerships are needed to guarantee the prevention and control of these arboviral diseases. Schools, workplaces, ministries, churches, and the general public should be firmly allied and committed to implementing the activities necessary for a collective response to the problem of arboviral diseases.

D. **Capacity building:** The IMS-arbovirus model requires that personnel be proactive in training human resources for each component in each country. This involves not only technical aspects, but also their interaction with the other components, while adopting scientific thinking to improve the response to these diseases and achieve a greater impact. Capacity building should be an ongoing activity that involves a planned effort to achieve the proposed objectives.

E. **Monitoring and evaluation:** Based on the evaluations of IMS-dengue, it was considered problematic to work with vector control impact indicators (e.g., infestation index). These indicators were not considered very rigorous, given the dynamics of disease transmission and the wide range of environmental and social determinants that influence transmission. As a result, in IMS-arbovirus, greater priority will be given to evaluating process indicators and monitoring the quality of technical work to achieve the goal and purpose of the strategy. This is vitally important for sound decision-making in the implementation of IMS-arbovirus.

5. Directives for the implementation of the IMS-arbovirus

In 2003, the Integrated Management Strategy for Dengue Prevention and Control (IMS-dengue) was presented in Resolution CD44.R9. In response to this resolution, the countries of the Region initiated the process of adopting a new working model for dengue prevention and control. Since then, 26 countries prepared, implemented, and evaluated their own national IMS-dengue, based on the regional IMS-dengue.

Recognizing that the current epidemiological context (endemic circulation of multiple arboviruses) requires a strategy that comprehensively addresses arboviral diseases, a new resolution was adopted by the PAHO Directing Council in September 2016. Resolution CD55.R6 urges Member States to adopt the strategy for arboviral disease prevention and control in the context of the specific conditions in each country.

In this framework of action, IMS-arbovirus seeks to strengthen regional and national technical capacities for: clinical diagnosis and care of patients with suspected arboviral diseases and their complications; integrated epidemiological surveillance of dengue [DENV], chikungunya [CHIKV], Zika [ZIKV], and other arboviral diseases with an impact on public health; integrated vector management; environment; and laboratory diagnosis, using a single, comprehensive surveillance system.

The activities can be implemented in accordance with the situation in each country, where scenarios may vary from countries that have not yet prepared an IMS, countries with a national IMS-dengue, and those which, during the PHEIC due to ZIKV, adapted their national IMS-dengue to include plans and strategies for dengue/chikungunya/Zika.

The following timetable was developed to guide the implementation of IMS-arbovirus in the Member States.

Table 5-1. Timetable of activities for the implementation of IMS-arbovirus

ACTIVITIES	2018 (Year 1)									2019 (Year 2							
	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	
Technical consultation (expert workshop) to update IMS-arbovirus 2016	X																
Publication of draft document for IMS-arbovirus 2018		X															
Dissemination of IMS-arbovirus 2018 to countries and territories (document sent to national authorities and international GT-Arbovirus)				X													
Restructure/reactivate National GT-Arbovirus (formation or consolidation)				X													
National workshop to prepare IMS-arbovirus or adjust existing national dengue/arbovirus plans or strategies, based on IMS-arbovirus 2018							X										
Dissemination of adjusted national IMS-arbovirus to national health councils or their equivalents in each country, subnational and local governments, national intersectoral commission (if applicable), scientific societies, academia, trade unions, and other social actors							X	X									
Arrangements made (with national and local governments, financial agencies, and international cooperation agencies) for financial resources to promote implementation of IMS-arbovirus 2018							X	X	X								
Implementation of the Plan of the national IMS-arbovirus								X	X	X	X	X	X	X	X	X	
Development and implementation of a continuous training plan for GT-Arbovirus and local managers											X	X	X	X	X	X	
Monitoring of components of the national IMS-arbovirus											X			X			
Self-evaluation of the adjusted national IMS-arbovirus													X				
External evaluation of the national IMS-arbovirus*																	
Establish evidence-based improvement processes (operations research based on a needs diagnosis for each component of IMS-arbovirus, as indicated in the self-evaluations)														X			

*Every 3 years

6. Monitoring and evaluation

The implementation and operation of IMS-arbovirus must be complemented with evaluation and monitoring activities that identify progress and limitations in order to align and focus resources on achieving results in every country of the Region.

Lines of action were identified for monitoring and evaluation, with their corresponding process indicators, implementation periods, and verification sources. In addition, an evaluation manual will be prepared and made available to the countries. When it becomes available at the end of 2019, it will serve as the policy document that governs regional and national evaluation processes.

Table 6-1. Lines of action, indicators, implementation periods, and verification sources for IMS-arbovirus monitoring and evaluation processes

Line of action	Indicator	Implementation period	Verification sources	Observations
Situation assessment of the country's approach to arboviral diseases	Number of countries with a situation assessment of the approach to arboviral diseases/ Total number of countries in the Region	Short-term (6 months)	Country SWOT document	This would be the starting point for monitoring and evaluation
IMS-arbovirus adapted in each country	Number of countries with adapted IMS-arbovirus/ Total number of countries in the Region	Short-term (Deadline: end 2018)	National IMS-arbovirus document	A resolution of the PAHO Directing Council, signed by the ministers of health of each country, recognizes that the countries have adopted IMS-arbovirus
Form, establish, and begin operations of GT-Arbovirus and of the steering group of the national IMS-arbovirus	Number of countries that have a national GT-Arbovirus/ Total number of countries in the Region Number of countries that have a steering group/ Total number of countries in the Region	Short-, medium-, and long-term (Deadline for forming the groups: end 2018)	Official document appointing the group; minutes of meetings	National GT-Arbovirus would represent these areas: epidemiology, IVM, virology laboratory, communications, environmental health, patient care/health services IMS-arbovirus steering group would consist of: directors of key areas such as epidemiology, health services, laboratory, health promotion, environment, and planning

Lines of action	Indicators	Implementation time	Verification sources	Observations
Results from monitoring of national IMS-arbovirus components sent to coordinator of IMS-arbovirus steering group	Number of countries that monitor the components of IMS-arbovirus/ Total number of countries in the Region	Short-, medium-, long-term (semiannually)	Technical reports on the components of IMS-arbovirus	Each component will refer to its own indicators, established in the adjusted IMS-Arbovirus, with reports to the steering group
Self-evaluations of IMS-arbovirus operations	Number of countries that conduct self-evaluation of IMS-arbovirus operations/ Total number of countries that adopted IMS-arbovirus	Medium- and long-term (biennial)	Evaluation report	PAHO will prepare a standardized self-evaluation instrument
External evaluations carried out	Number of countries that have been evaluated externally/ Total number of countries that adopted the strategy	Medium-term (every three years)	Evaluation report issued by the evaluating entity	International GT-Arbovirus and PAHO should participate; creation of a standardized evaluation document to be used in all countries
Meetings to share lessons learned within the framework of IMS-arbovirus implementation	Number of meetings held	Medium/long-term (biennial)	Meeting report	On-site or virtual meetings; meetings should begin after external evaluation

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Annexes

Annex A. SWOT analysis, by component

SWOT analysis (analysis of Strengths, Weaknesses, Opportunities, and Threats) is a methodological tool used in the study of an existing situation. This tool enables us to proactively and systematically search for and analyze strategic variables to fully inform decision-making. SWOT analysis also looks at the internal characteristics of the situation (strengths and weaknesses), as well as the external environment (threats and opportunities), to generate a matrix that can be interpreted both horizontally and vertically. This matrix can be used to develop the necessary strategies for meeting the proposed objectives.

It is extremely important to use the SWOT matrix when developing strategies with the logical framework approach. Once the goal and purpose are established, each of the components will eliminate its weaknesses by turning them into expected outcomes aimed at meeting the proposed goal and by turning strengths into special capabilities that will foster the implementation of activities and tasks. In the logical framework matrix, threats (i.e., situations that hinder achievement of the goal) become the assumptions/risks that need to be taken into account to ensure the success of the planned activities.

Annex A-1. SWOT Analysis: management component

STRENGTHS	WEAKNESSES
• Political support from the countries, through PAHO Resolution CD55.R6, which resolves to adopt IMS-arbovirus • An agreement among the countries to develop their capacity to detect, evaluate, and report public health events within the IHR framework • Experience in the Region of the Americas with the implementation and evaluation of IMS-dengue • An international technical group (GTI-Dengue) and a regional group, as well as operational teams engaged in technical work	• The integration and development of epidemiological surveillance in health care practice is uneven • Poor coordination of the different components of IMS-arbovirus at the intra- and extra-sectoral levels • Some health authorities express limited political commitment to the sustainable allocation of resources to implement IMS-arbovirus • Poor development of operations research to provide evidence for decision-making within the framework of IMS-dengue • Lack of regular, sustainable activities for surveillance and prevention of arboviral diseases • Heterogeneity in the appointment and performance of national and subnational managers, resulting in different levels of hierarchy and competency to lobby health authorities and to viably implement IMS-arbovirus • Low impact of public communication strategies to induce changes in attitudes and behaviors regarding arboviral diseases • Health teams are not sufficiently trained in the diagnosis and clinical management of arboviral diseases • Lack of financial and logistic resources to tackle PHEICs caused by ZIKV
OPPORTUNITIES	**THREATS**
• Implementation of IMS-arbovirus was facilitated by the public impact of the disability and deaths caused by arboviral diseases • Due to the emergence of new arboviral diseases and their impact on national economies, other sectors and political and economic groups have become interested in participation and financing • Incorporating new technologies can improve entomological surveillance, health promotion, risk communication, and disease prevention and control • Availability of PAHO funds to train health workers in clinical management and surveillance of arboviral diseases • Availability of resources to support operations research	• Globalization facilitates rapid introduction and dispersion of new pathogens • Political changes can affect the continuity of IMS-arbovirus • Climate change favors the persistence and dispersion of arboviral diseases • Social inequity and greater poverty increases the vulnerability of populations to arboviral diseases • Disorderly urban growth creates enabling environments for the development of arboviral diseases • New technologies can become barriers to achieving and sustaining changes in people's attitudes

Annex A-2. SWOT Analysis: epidemiology component

STRENGTHS	WEAKNESSES
• IMS-dengue has been developed, implemented, and evaluated in the countries of the Region of the Americas since 2003 • A system for weekly reporting of arboviral disease cases in the countries of the Americas • Epidemiological surveillance of arboviral diseases, with interventions in response • Capacity to diagnose arboviral diseases • Health workers with knowledge in epidemiological and laboratory surveillance • Multidisciplinary groups tackle outbreaks and epidemics • Adequate integration of epidemiological and laboratory surveillance • Adequate coordination between laboratory, epidemiology, vector personnel, and health promotion	• Need to strengthen the process of integrating arboviral diseases into epidemiological surveillance • Laboratory monitoring in serology has been debilitated by cross-reactions between arboviral diseases • Need to strengthen health workers' knowledge about diagnostic protocols and patient care • Health workers need permanent training in epidemiological surveillance • Poor understanding of the synergies among the three arboviral diseases and others through space and time • Insufficient human resources trained in epidemiological and laboratory surveillance and clinical management • Insufficient coordination between epidemiological and entomological surveillance • Poorly integrated surveillance system for febrile illness with skin rashes • Lack of a model to address arboviral diseases • There is no established network for research, support, and joint efforts among countries for the prevention and control of arboviral diseases • Surveillance system is weak with respect to arbovirus-associated events and mother-to-child and sexual transmission
OPPORTUNITIES	**THREATS**
• New technologies (multiplex/trioplex) will improve the diagnosis of arboviral diseases • Countries and agencies have the political will to cooperate, given the reintroduction and introduction of new arboviral diseases • Rapidly update standards to combat different pathologies • Adapt IMS-dengue to epidemiological surveillance of arboviral diseases • New technologies available for use of information sources that support epidemiological surveillance	• Population is susceptible to new arboviral diseases and cross-reactions • The structural determinants affecting the presence of diseases remain the same: sanitation, water, and risk management • Perception of low risk and little community participation • Insufficient private sector participation • In epidemic outbreaks, basic competency criteria for staff recruitment are not applied • Climate change and global warming favor vector proliferation and adaptation • Population is susceptible to the new arboviruses • High migration flows favor the spread of pathogens • Expansion of agriculture affects integrated vector management • Changes in government structures undermine the sustainability of any strategy, especially IMS-arbovirus

Annex A-3. SWOT Analysis: patient care component

STRENGTHS	WEAKNESSES

• Existence of and access to regional protocols for case management of patients with suspected arboviral disease, available in electronic and print format • Growing number of health professionals in the Region • Professionals with expertise in the management of arboviral diseases in the Region. • Multidisciplinary groups are participating in research in the Region • Systems for mandatory reporting of cases of arboviral disease in the countries • Epidemiological information at the regional level is better, more reliable, and available in real time • Coordinated regional operations research strategies • Integrated approach to clinical care, vector control, and social communication	• Difficulties in the practical implementation of case management protocols for patients with suspected arboviral disease • Health professionals do not know the protocols for case management • Professionals fail to comply with existing case management protocols for patients with suspected arboviral disease • High turnover of health workers responsible for patients with suspected arboviral disease • Not enough health professionals are trained in case management of patients with suspected arboviral disease • Lack of monitoring or follow-up on the commitment of multipliers to conduct national trainings • Poor distribution of health professionals at all levels of care • Little knowledge of high-level scientific evidence for case management of patients with suspected arboviral disease • Lack of clinical characterization based on reliable laboratory evidence supporting differential diagnosis in cases of suspected arboviral disease • Lack of a specific antiviral treatment for arboviral diseases • Poor records of signs and symptoms in clinical case files for suspected arboviral disease
	• Published IHR is not in line with regional criteria for classification of arboviral diseases • Prognostic criteria of severity have not been defined nor standardized for some arboviral diseases (not including dengue) • Health professionals do not recognize the shock phase in the initial stage of the disease • Health professionals do not perform differential clinical diagnosis among arboviral diseases • Mild forms of yellow fever are not recognized for timely clinical diagnosis • Difficult or no access to health services • Deficiencies at the primary care level in terms of case management of suspected arboviral disease • Lack of clinical laboratory support for adequate management of severe cases (excluding laboratory diagnosis) • Difficulty with imaging studies of pregnant women with suspected Zika • Poor availability of resources for the implementation of new technologies • Lack of contingency plans at the local level for outbreaks and epidemics
OPPORTUNITIES	**THREATS**

• Use of new technologies for the development of mobile applications that permit field implementation of protocols • Use of health professionals already trained in case management of suspected arboviral disease • Quality of case management can be improved by properly training health professionals • Financial support is available for operations research • Promotion of clinical research • Strengthening health care at all levels to guarantee clinical assessment of quality	• Introduction of new arboviral diseases or other viruses with great dissemination capacity • High turnover among health workers in charge of patients with suspected arboviral disease • A large accumulation of susceptible individuals facilitates new outbreaks/epidemics • Increased migratory movements • Changes or mutations in the serotypes of circulating arboviruses • Economic crises • Sustainability of the contingency plans for outbreaks and epidemics

Annex A-4. SWOT Analysis: laboratory component

STRENGTHS	WEAKNESSES
• Regional RELDA established • Implementation of harmonized protocols for the Region • Countries with established internal networks • Staff trained in laboratory diagnosis of arboviruses • Technological platforms established to facilitate rapid and sustained communication • 16 level-3 biosafety laboratories (BSL3) • 85-90% of countries with molecular methods for diagnosis • Four WHO collaborating centers near laboratories • Availability of EQA	• Insufficient implementation of quality management systems and insufficient financial resources to maintain them • Insufficient availability of reagents, despite progress • Difficulties in mobilizing biological material (customs restrictions and problems with courier services) • Difficulties in preserving samples for transportation (traceability/cold chain) • Need to strengthen biocontainment, biosafety, and good laboratory practices • Lack of specific methodologies for serology (differential diagnosis) • Not enough trained staff • Deficiencies in the validation of serological cases (operations research) • Limited capacity for detection of new pathogens (emerging arboviruses) • National reference laboratories overloaded with duties other than surveillance (e.g., individual diagnosis), affecting their capacity to conduct core activities • Understanding the pathology, kinetics, infection, and interaction (interference) of different viruses in the host
OPPORTUNITIES	**THREATS**
• Development of new methodologies and more efficient diagnostic systems • Development of new knowledge through research, including multicenter studies • Optimization of procurement processes (tenders) for commercial kits, taking advantage of the knowledge generated in RELDA • Integration of the different components of surveillance, management, and control within the framework of IMS-arbovirus • Technology transfer for the production of nonmarket reagents • Implementation of genomic sequencing in surveillance processes • Decentralization of surveillance processes in national networks • More laboratories in the Region take part in rounds of EQA • Fostering integration with other networks/institutions/agencies • Implementation of entomo-virologic surveillance of vectors and reservoirs	• Instability of the workforce (high turnover, temporary contracts) • Budget limitations • Emergence of other arboviruses • Sustainable supply of reagents • Commercial kits tendered/procured based on price and not on technical characteristics or the specifications of the laboratory of reference • Decision-making on use of reagents/methodologies not coordinated with laboratories • Laboratories not included in decision-making on surveillance, prevention, and control

Annex A-5. SWOT Analysis: integrated vector management component

STRENGTHS	WEAKNESSES
• Countries' experience with IMS-dengue, in different degrees of implementation • PAHO Technical Advisory Group on Public Health Entomology (TAG PHE) • Regulations or technical guidelines are in place for vector control in the countries of the Region • Regional resolutions on integrated vector management are in place • Organizational structure for vector control in the countries • Incipient insecticide monitoring network in several countries • Operations research on new technologies in the countries	• Insufficient human resources to ensure quality coverage in terms of training and competition • Loss of human resources due to worker turnover • Insufficient continuous training programs • Poor integration of entomological and epidemiological surveillance systems and other systems for decision-making • Entomological indicators not used for integrated situation analysis • Integrated vector management strategies conceptualized but not implemented • Countries need technical support to implement IVM • Countries need to update entomological surveillance systems and adapt to the IVM approach • Lack of coordination among the different components of IMS-arbovirus • Insufficient collaboration among countries to control arboviral diseases • Inadequate management and coordination of national and subnational vector prevention and control programs • Incorrect implementation of decentralization in some countries' programs • Structural weakness of vector control programs • Insufficient operations research in countries to enable evidence-based decision-making
OPPORTUNITIES	**THREATS**
• Countries of the Region are sensitized to the need to implement IVM • The effects of the PHEIC due to Zika, as well as other emerging and reemerging arboviral diseases, create a favorable situation for restructuring and strengthening IVM programs • Advances in new technologies for vector control • Installed capacities in universities and research centers • PAHO/WHO and other international agencies are ready to help strengthen programs in the countries.	• Permanent changes in the political priorities of governments • Vector resistance to insecticides used in public health • Risk perception in the population, who believe that insecticide application is what controls vectors • Control of vector-borne diseases is not at the top of the political agenda • Adverse climate events • Socioeconomic vulnerability in countries affects the response capacity of vector control programs • Vector control personnel asked to carry out unrelated tasks in emergencies, hindering performance of their regular duties • Community perception that vector control is exclusively a responsibility of the government

Annex A-6 SWOT Analysis: environment component

STRENGTHS	WEAKNESSES
• Regulations enforced to reduce the proliferation of breeding sites (tires, flowerpots, etc.) in several countries of the Region • Legal sanctions in some countries for the creation of breeding sites during construction in urban areas • Municipal regulations in several countries include penalties for generating breeding sites • Organized private sector participation • Mobilization of all stakeholders (health sector and other sectors), although only during epidemics or PHEICs • Environmental issues addressed by several actors (health, environment, housing, local government) • Existence of budgets for environmental public health interventions	• Lack of participation by key actors working on social determinants (water, sanitation, garbage collection, migration, etc.) in relation to outbreak prevention and response • Few public policies to protect the environment and prevent breeding sites • Little participation of families and communities in physical control of the vector breeding sites within their scope of action • Sector has no regulatory entity with a role in environmental health issues and in the institutions in charge of addressing them (local government and others). • Little or no perception of risk on the part of the population • Widespread use of insecticides for vector elimination not supported by environmentalist groups • Lack of sustainable budgets to maintain a healthy environment • Environmental health issues not on the agenda of the environment sector • Funds allocated for environmental public health interventions are used for other programs
OPPORTUNITIES	**THREATS**
• Territorial management to strengthen stewardship in environmental health issues, through a defined agenda that establishes roles and responsibilities for each actor • International Health Regulations (IHR 2005) is a binding document that requires countries to prevent the international spread of diseases and includes measures related to vector-borne diseases • Human resources trained but limited by high turnover • Health situation analysis (used by countries as a planning tool) is not strongly developed in environmental indicators • Recognition of the financial impact of these diseases at the country level, due to the high cost of intervention and spread that can interfere in trade	• In health ministries, the structure of environmental health has weakened over time. Currently, it is poorly developed and focused on vector surveillance and control, and management of safe water and solid waste, where it does not have a stewardship role • Lack of agreements on joint efforts between the health sector and other involved sectors • Weak health sector advocacy on issues related to improving environmental health • Poorly defined environmental health priorities within research priorities • Need to raise stakeholders' awareness of the importance of interventions in environmental health • Lack of information on available environmental indicators; and, where they exist, they are underutilized • Health promotion related to territorial management does not take a comprehensive approach to health and does not consider the need for multisectoral intervention • Existing prevention and control plans are only within the health sector; multisectoral plans have not been implemented. • Weak national programs and strategies to address environmental health issues

Annex B. Guides and documents

Annex B-1. Guides and technical documents, by component

Management component

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Laboratory component

Instituto de Medicina Tropical "Pedro Kouri" Ministerio de Salud Pública. Técnicas de laboratorio para el diagnóstico y la caracterización de los virus del dengue [Internet]. Havana, Cuba; 2009. Available at: http://new.paho.org/hq/dmdocuments/2011/Protocolos_Dengue_IPK_2009_I.pdf.

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Annex B-2. Complementary guides and technical documents

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Annex C. Technical consultation agenda

Technical consultation on the strategy for arboviral disease prevention and control in the Americas. Bucaramanga, Colombia, 9-12 August 2016.

Tuesday, 9 August 2016

Time	Activity	Responsible institution / person
8:00 - 8:30	Registration of participants	
8:30 - 9:00	Welcoming remarks	Dr. Luis Villar – Universidad Industrial de Santander – RED Aedes Dr. Gina Watson, PWR Colombia Dr. Enrique Pérez, IHR Unit Chief
9:00 - 9:20	Introduction of participants and review of the workshop agenda/General remarks	Dr. José Luis San Martín – Regional Advisor on Dengue
9:20 - 9:50	The new challenges of chikungunya and Zika virus fever for the Americas	Dr. Enrique Pérez, IHR Unit Chief
9:50 - 10:20	IMS-dengue: Current platform as the foundation for work (strengths and weaknesses)	Dr. José Luis San Martin, Regional Advisor on Dengue
10:20 - 10:40	Coffee break	
Plenary: Preparation of the SWOT analysis on arboviral disease prevention and control **Dr. Linda Lloyd**		
10:40 - 11:10	Presentation of methodology for participatory construction, groups and stages of work, objectives at the end of the workshop, basic documents. Doubts and initial clarifications	Dr. José Luis San Martín, Regional Advisor on Dengue
11:10 - 11:40	Formation of working groups, by component: Guidance for preparation of the SWOT (Strengths, Weaknesses, Opportunities, and Threats) matrix for implementing IMS-arbovirus in the Americas	Facilitators
11:40 - 12:30	Group work, by component: Preparation of the SWOT matrix analysis for arbovirus control in the countries and territories of the Americas, based on the strategy's facilitating factors	Facilitators
12:30 - 14:00	Lunch	
Development of IMS-arbovirus components: group work		

14:00 - 14:15	Formation of working groups by component*. Guidance for group work. Working groups: Management, Epidemiological Surveillance, Laboratory Diagnosis, Integrated Vector Management, Patient Care	Facilitators
14:15 - 16:00	Beginning of group work	
16:00 - 16:20	Coffee break	
16:20 - 17:40	Continuation of group work, by component	
17:40 - 17:50	Closure/conclusions	Dr. José Luis San Martín, Regional Advisor on Dengue
17:50 - 18:00	Meeting of Select Committee of the Coordinating Group	Dr. José Luis San Martín, Regional Advisor on Dengue

* Each group will have a coordinator. Social communication and operations research will be part of each working group.

Wednesday, 10 August 2016

Time	Activity	Responsible institution / person
8:30 - 10:00	Continuation of group work by component	Group coordinators
10:00 - 10:30	Coffee break	
10:30 - 12:30	Continuation of group work by component	Group coordinators
12:30 - 14:00	Lunch	
14:00 - 15:30	Continuation of group work by component	Group coordinators
15:30 - 15:50	Coffee break	
15:50 - 17:30	Continuation of group work by component	Group coordinators
17:30 - 17:40	Closure/ conclusions	Dr. José Luis San Martin, Regional Advisor on Dengue
17:40 - 18:00	Meeting of Select Committee of the Coordinating Group	Dr. José Luis San Martin, Regional Advisor on Dengue

Thursday, 11 August 2016

Time	Activity	Responsible institution / person

8:30 – 10:30	Plenary session, presentations of the working groups: management, epidemiology, laboratory, integrated vector management, patient care 10-minute group presentations, 5 minutes of questions from the plenary per presentation, and 30 minutes of plenary discussion	Group coordinators
10:30 – 11:00	Coffee break	
11:00 – 12:30	Continuation of the group work, by component: inclusion of final changes	Group coordinators
12:30 – 14:00	Lunch	
14:00 – 15:30	Multidisciplinary working groups are formed and begin work: IMS-arbovirus, contingency plan, monitoring and evaluation, annexes	Group coordinators
15:30 – 15:50	Coffee break	
15:50 – 17:30	Continuation of multidisciplinary group work	Group coordinators
17:30 – 17:40	Closure/conclusions	Dr. José Luis San Martin, Regional Advisor on Dengue

Friday, 12 August 2016

Time	Activity	Responsible institution / person
8:30 – 9:30	Presentation of multidisciplinary working groups	Group coordinators
9:30 – 10:00	Discussion of the presentations of the multidisciplinary groups	
10:00 – 10:30	Coffee break	
10:30 – 12:30	Changes to IMS-arbovirus based on the discussions of the multidisciplinary groups and definition of next steps	Group coordinators
12:30 – 14:00	Lunch	
14:00 – 15:30	Continuation of changes to IMS-arbovirus	Group coordinators
15:30 – 15:50	Coffee break	
15:50 – 17:30	Presentation of the preliminary IMS-arbovirus document	Group coordinators
17:30 – 18:00	Close of workshop	Dr. José Luis San Martín, Regional Advisor on Dengue

Annex D. List of participants in the technical consultation

Technical consultation on the strategy for arboviral disease prevention and control in the Americas. Bucaramanga, Colombia, 9-12 August 2016.

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Annex D-1. Photo of the technical consultation group
Technical consultation on the strategy for arboviral disease prevention and control in the Americas. Bucaramanga, Colombia. 9-12 August 2016.

Annex E. Agenda of the regional workshop

Regional workshop for the review and adjustment of the strategy for arboviral disease prevention and control. Guatemala, 17-20 April 2018.

Tuesday, 17 April 2018

Time	Activity	Responsible institution / person
8:00 – 8:30	Registration of participants	
8:30 – 9:00	Opening remarks	Ministry of Health of Guatemala PAHO/WHO Representative Office Guatemala
9:00 – 9:20	Introduction of participants Review of the workshop agenda and methodology General comments	Dr. José Luis San Martín, PAHO/WHO
9:20 – 9:40	Contextualizing IMS-dengue and the process of preparing IMS-arbovirus	Dr. Romeo Montoya, PAHO/WHO
9:40 – 10:25	Round table: Components of IMS-arbovirus (part one) Presentations will be 15 minutes each: 1. Management 2. Epidemiology 3. Laboratory	Facilitator: Dr. José Luis San Martín, PAHO/WHO Speakers: 1. Dr. Héctor Coto, PAHO/WHO 2. Dr. Thais Dos Santos, PAHO/WHO 3. Dr. Jairo Méndez, PAHO/WHO
10:25 – 10:45	**Group photo** **Coffee break**	
10:45 – 11:30	Round table: Components of IMS-arbovirus (part two) Presentations will be 15 minutes each: 4. Integrated vector management 5. Patient care 6. Environment	 4. Dr. Haroldo Bezerra, PAHO/WHO 5. Dr. Gamaliel Gutiérrez, PAHO/WHO 6. Dr. Marcelo Korc, PAHO/WHO
11:30 – 12:00	Questions and observations	
12:00 – 13:00	**Lunch**	
Linchpin **Operations research**		
13:00 – 13:30	Methodology to define priority research topics	Dr. Freddy Pérez, PAHO/WHO
Preparation of SWOT analysis: Arboviral disease prevention and control		
13:30 – 13:50	Presentation of methodology for the SWOT analysis Questions and initial clarifications	Dr. Linda Lloyd

13:50 – 14:00	Formation of working groups, by component[2]: Guidelines for the preparation of the SWOT matrix (Strengths, Opportunities, Weaknesses and Threats) to implement IMS-arbovirus in the Americas 1. Management 2. Epidemiology 3. Laboratory 4. Integrated vector management 5. Patient care 6. Environment	Facilitator: Dr. Linda Lloyd Working group coordinator 1. Dr. Héctor Coto, PAHO/WHO 2. Dr. Carlos Saenz 3. Dr. María Guadalupe Guzmán 4. Dr. Haroldo Bezerra, PAHO/WHO 5. Dr. Ernesto Pleites 6. Dr. Marcelo Korc, PAHO/WHO
14:00 – 15:30	Group work on each component: Preparation of the SWOT analysis matrix for IMS-arbovirus	Facilitator: Dr. Linda Lloyd
15:30 – 16:15	Presentation of SWOT analysis for each component: 1. Management 2. Epidemiology 3. Laboratory 10 minutes per presentation and 5 minutes for questions	Working group coordinators
16:15 – 16:30	**Coffee break**	
16:30 – 17:15	Presentation of SWOT analysis for each component: 4. Integrated vector management 5. Patient care 6. Environment 10 minutes per presentation and 5 minutes for questions	Working group coordinators
17:15 – 17:45	Adjustments to SWOT analysis, based on comments	Working group coordinators
17:45 – 17:55	Turn in developed materials to Integration group	Coordinators of working groups Integration group
17:55 – 18:00	Closure/conclusions	Dr. José Luis San Martín, PAHO/WHO
18:00 – 18:30	Meeting of the Coordinating group	Dr. José Luis San Martín, PAHO/WHO

[2] Each group will have a work coordinator. Social communication and operations research will be part of each working group.

Wednesday, 18 April 2018

Time	Activity	Responsible institution / person
Review and adjustments to the components of IMS-arbovirus: group work		
8:30 – 9:30	Proposed classification of Zika: consultation	Dr. Thais Dos Santos, PAHO/WHO

9:30 – 9:45	Creation of a working group for each component Guidance for group work Working groups 1. Management 2. Epidemiology 3. Laboratory 4. Integrated vector management 5. Patient care 6. Environment	Dr. José Luis San Martín, PAHO/WHO Working group coordinators 1. Dr. Héctor Coto, PAHO/WHO 2. Dr. Carlos Saenz 3. Dr. María Guadalupe Guzmán 4. Dr. Haroldo Bezerra, PAHO/WHO 5. Dr. Ernesto Pleites 6. Dr. Marcelo Korc, PAHO/WHO
9:45 – 10:20	Beginning of group work on each component	Group coordinators All
10:20 – 10:40	**Coffee break**	
10:40 – 12:30	Group work on each component (continued)	Working group coordinators
12:30 – 14:00	**Lunch**	
14:00 – 16:00	Group work on each component (continued)	Working group coordinators
16:00 – 16:20	**Coffee break**	
16:20 – 17:20	Group work on each component (continued)	Working group coordinators
17:20 – 17:30	Closure/conclusions	Dr. José Luis San Martín, PAHO/WHO
17:30 – 18:00	Meeting of the Coordinating group	Dr. José Luis San Martín, PAHO/WHO

Thursday, 19 April 2018

Time	Activity	Responsible institution / person
8:30 – 10:30	Presentations by the working groups for each component: 1. Management 2. Epidemiology 3. Laboratory 4. Integrated vector management 5. Patient care 6. Environment 10-minute presentations by each group, plus 5 minutes of plenary questions, per presentation, and 30 minutes of plenary discussion	Working group coordinators 1. Dr. Héctor Coto, PAHO/WHO 2. Dr. Carlos Saenz 3. Dr. María Guadalupe Guzmán 4. Dr. Haroldo Bezerra, PAHO/WHO 5. Dr. Ernesto Pleites 6. Dr. Marcelo Korc, PAHO/WHO Facilitator: Dr. Linda Lloyd
10:30 – 10:50	**Coffee break**	
10:50 – 12:10	Group work on each component (continued) Changes will be based on the plenary discussion	Working group coordinators
12:10 – 12:30	Turn in changes to the Integration group	Working group coordinators Integration group

12:30 – 14:00	**Lunch**	
14:00 – 16:20	Multidisciplinary working groups are formed and begin work: 1. IMS-arbovirus 2. Monitoring, evaluation 3. Annexes of the document 4. Implementation plan 5. Operations research	Working group coordinators 1. Dr. Gamaliel Gutiérrez, PAHO/WHO 2. Dr. Carlos Saenz 3. MSc. Jaime Juárez, PAHO/WHO 4. Dr. Leticia Franco, PAHO/WHO 5. Dr. Freddy Pérez, PAHO/WHO Facilitator: Dr. Linda Lloyd
16:20 – 16:40	**Coffee break**	
16:40 – 17:30	Multidisciplinary group work (continued)	Working group coordinators
17:30 – 17:40	Closure/conclusions	Dr. José Luis San Martín, PAHO/WHO
17:40 – 18:00	Meeting of the Coordinating group	Dr. José Luis San Martín, PAHO/WHO

Friday, 20 April 2018

Time	Activity	Responsible institution / person
8:30 – 10:15	Presentations by multidisciplinary working groups: 1. IMS-arbovirus 2. Monitoring, evaluation 3. Annexes of the document 4. Implementation plan 5. Operations research 10-minute presentations by each group, plus 5 minutes of plenary questions, per presentation, and 30 minutes of plenary discussion	Working group coordinators 1. Dr. Gamaliel Gutiérrez, PAHO/WHO 2. Dr. Carlos Saenz 3. MSc. Jaime Juárez, PAHO/WHO 4. Dr. Leticia Franco, PAHO/WHO 5. Dr. Freddy Pérez, PAHO/WHO
10:15 – 10:40	**Coffee break**	
10:40 – 12:30	Changes to IMS-arbovirus based on the presentation of the multidisciplinary groups and plenary discussion	Working group coordinators
12:30 – 14:00	**Lunch**	
14:00 – 15:50	Changes to IMS-arbovirus based on the presentation of the multidisciplinary groups and plenary discussion (continued)	Working group coordinators
15:50 – 16:20	Turn in changes to the Integration group	Working group coordinators Integration group
16:20 – 16:40	**Coffee break**	
16:40 – 17:30	Presentation of the preliminary IMS-arbovirus document	Integration group

17:30 – 17:40	Closure of the workshop	Dr. José Luis San Martín, PAHO/WHO
17:40 – 18:00	Meeting of the Coordinating group	Dr. José Luis San Martín, PAHO/WHO

Annex F. List of participants in the regional workshop

Regional workshop for the review and adjustment of the strategy for arboviral disease prevention and control. Guatemala, 17-20 April 2018.

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Annex F-1. Photo of the regional workshop group

Regional workshop for the review and adjustment of the strategy for arboviral disease prevention and control in the Americas. Guatemala City, Guatemala. 17-20 April 2018.

The Integrated Management Strategy for the Prevention and Control of Arboviral Disease in the Americas (IMS-arbovirus) offers a methodology and management model with clearly defined objectives and strategic lines. Based on conditions in the Region, each component of IMS-arbovirus is grounded in best practices. The model is easily applicable to local conditions and is constantly enhanced by operations research and scientific advances, which has made it sustainable over time. This document is mainly for health ministers and managers at the various levels of the health system. It offers detailed information on the performance indicators, expected results, activities, and tasks necessary for strengthening national and local technical capacities for the prevention and control of arboviral disease.

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