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Strengthening One Health systems in the Mediterranean, Sahel, Black Sea and Balkan Regions: lessons learned from the MediLabSecure activities

Strategic Document 2024

Edited by
C. Robbiati, A. Milano, M. Habib, S. Declich,
A. Ranghiasci, G. Nacca, M.G. Dente

EPIDEMIOLOGIA
E SANITÀ PUBBLICA

ISTITUTO SUPERIORE DI SANITÀ

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2024, xi, 36 p. Rapporti ISTISAN 24/35

In 2007 the public health institutes and ministries of health of the countries of the Mediterranean Basin and Middle East started to collaborate in the framework of the EpiSouth network to strengthen surveillance and control of threats to health. Since then, the collaboration consolidated and also several laboratories of 22 non-EU Member States are part of the network named MediLabSecure (MLS) supported by the European project started in 2014 to enhance surveillance and control of arbovirus infections with a One Health (OH) approach. After the 1st phase of MLS (2014-2018) relevant results and lessons learned were discussed in a first strategic document *(Rapporto ISTISAN* 18/20). A 2nd project's phase was implemented in the period 2019-2024 and the present document highlights relevant lessons learnt emerged during the implementation of the activities to share actionable recommendations with the project's stakeholders by focusing on those aspects which can reinforce the OH national systems.
Key words: Arbovirus infections; Surveillance; One Health

Istituto Superiore di Sanità
Rafforzare i sistemi One Health nelle regioni del Mediterraneo, del Sahel, del Mar Nero e dei Balcani: lezioni apprese dalle attività di MediLabSecure. Documento strategico 2024.
A cura di Claudia Robbiati, Alessia Milano, Maham Habib, Silvia Declich, Alessia Ranghiasci, Gloria Nacca, Maria Grazia Dente
2024, xi, 36 p. Rapporti ISTISAN 24/35 (in inglese)

Nel 2007 gli istituti di sanità pubblica e i ministeri della salute dei paesi del bacino del Mediterraneo e del Medio Oriente hanno iniziato a collaborare nel quadro della rete EpiSouth per rafforzare la sorveglianza e il controllo delle minacce per la salute. Da allora, la collaborazione si è consolidata e anche diversi laboratori di 22 stati membri non UE fanno parte della rete denominata MediLabSecure (MLS) supportata dal progetto europeo avviato nel 2014 per migliorare la sorveglianza e il controllo delle arbovirosi con un approccio One Health (OH). Dopo la prima fase di MLS (2014-2018) i risultati rilevanti e le lezioni apprese sono stati discussi in un primo documento strategico (*Rapporto ISTISAN* 18/20). Una seconda fase del progetto è stata implementata nel periodo 2019-2024 e il presente documento evidenzia le lezioni apprese emerse durante l'implementazione delle attività per condividere raccomandazioni atte a rafforzare i sistemi nazionali OH.
Parole chiave: Infezioni da arbovirus; Sorveglianza; One Health

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with the participation and support of the countries of MediLabSecure Network[1]

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The document has been finalised with the collaboration and support of an *ad hoc* Scientific Board:

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[1] List of countries Institutions in Appendix A

[*] This designation is without prejudice to positions on status and is in line with UNSCR 1244 and ICI Advisory opinion on the Kosovo declaration of independence

[**] This designation shall not be construed as recognition of a State of Palestine and is without prejudice to the individual positions of EU Member States on the issue

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PREAMBLE

The Chemical, Biological, Radiological, and Nuclear Risk Mitigation Centres of Excellence initiative (CBRN) of the European Union aims at enhancing global security by improving the capacity of partner countries to manage and mitigate CBRN risks through improved governance, cooperation, capacity building, and innovation.

In a globalized world, biological threats represent a significant component of CBRN hazards, pathogens spread easily worldwide and may cause extensive harm and disruption as illustrated by recent health crisis. As the health of humans, animals, and ecosystems is inextricably linked, there is an urgent necessity of adopting a holistic approach. The One Health concept promotes collaborative efforts across various sectors to achieve optimal health, but its correct implementation remains a challenge.

Countries surrounding the European Union, in the Mediterranean, Black Sea and Sahel regions have diverse economic statuses, health infrastructures, and environmental challenges, and they are particularly vulnerable to vector-borne diseases, accentuated by climate change. Since 2014, the MediLabSecure project aims to enhance the surveillance and response to vector-borne diseases in this geographical area through a collaborative network of laboratories, public health institutions, and veterinary services in order to share knowledge, expertise and data.

For 10-year now, the project has promoted the institutional adoption of the One Health approach together with the consolidation of a One Health workforce. They advocate for integrated surveillance, risk assessment and early warning at national and regional level to prevent and control epidemics. MediLabSecure offers training programs and workshops for enhancing skills and knowledge, encourages new methods and protocols for surveillance and diagnostics, facilitates the sharing of resources, and ensures consistency and reliability in data and response strategies. This document summarizes results achieved as well as new challenges.

The long-term approach is starting to pay off. The beneficiary countries not only enthusiastically participate to trainings, but also suggest cooperation mechanisms at national and regional levels and push for the domestic institutional changes necessary for the proper operationalisation of One Health. Structural changes are difficult to achieve but MediLabSecure shows the path, supporting this transition as much as possible. A sustained effort is the key for success, and the European Union and partner countries will continue to work together to support a real tactical change in the fight against zoonosis, a strategy for sustainable development and resilience.

Anne Sophie Lequarré
Program Manager,
Global and Transregional Threats and Challenges
Service for Foreign Policy Instruments
European Commission

FOREWORD

For a decade, MediLabSecure (MLS) Project has strengthened preparedness capacities to tackle vector-borne diseases by promoting a holistic approach. By bringing together experts and scientists from different disciplines as well as local stakeholders through training programs and collaborative initiatives, the project allowed the setting up of a unique network of One Health (OH) trained workforce.

Guided by the humanist mission of the Institut Pasteur to contribute to the improvement of the population health, the Department of International Affairs is proud to animate the MLS Network which aims at preventing vector-borne diseases in countries of the Mediterranean region that are vulnerable to environmental degradations and climate change leading to a higher risk of vector-borne diseases emergence. To this end, the Department of International Affairs relies on a consortium of 6 European partners with complementary expertise composed of the Institut Pasteur, the Istituto Superiore di Sanità, the Institut de Recherche pour le Developpement, Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria, Consejo Superior de Investigaciones Científicas, Istituto Zooprofilattico Sperimentale dell'Abruzzo e del Molise «G. Caporale» and Avia-GIS.

The promotion of inter- and trans-sectoral actions towards One Health surveillance is the core of the MLS Project. As such, the Istituto Superiore di Sanità (ISS) with their recognized expertise in developing guidance to public health policies, carried out situational analyses on integrated surveillance in pilot countries. These studies sustained the production of this Strategic document, one of the key deliverables of the project, which provides evidence and recommendation for the setting up of an integrated surveillance. These activities along with training and networking actions contributed to raise awareness on the added value of implementing an OH approach around the critical issues of infectious disease prevention and management.

This document also takes the opportunity of the 10-year anniversary of the project to share the lessons learned after a decade of capacity building to support OH adoption, while providing recommendations to guide future initiatives in the field. Some of the implemented activities are highlighted to illustrate the strategy of the project and demonstrate how shared expertise and developed tools contributed to improve integrated surveillance and vector-borne diseases control practices in partner countries. We hope that this retrospective dedicated to the network's members and stakeholders involved in infectious diseases management will guide future actions, strengthening the foundation for a sustainable and effective approach.

May the lessons learned and recommendations from this collective experience inspire the MLS Network's members and be used as an advocacy tool to initiate dialogue with policy makers and contribute to leverage the political engagement towards OH implementation.

In the next opus of the project, on a member voluntary basis, we will support network's members in this endeavour.

Odette Tomescu-Hatto
Executive Vice-President of International Affairs
Institut Pasteur

PREFACE

The main mission of the Istituto Superiore di Sanità is to provide guidance to public health policies on the basis of researches and studies that are being conducted in multiple domains.

In particular, our Institute, thanks to the availability of a plurality of skills and competencies, is implementing multidisciplinary collaborations and joint actions, transversal to its reference research sectors, to promote the One Health approach necessary to cope with present and future challenges.

We are therefore honoured to have given for more than ten years our contribution to the implementation of MediLabSecure (MLS) activities, whose aim is to reinforce prevention and preparedness with a One Health approach.

This second strategic document aims to contribute to the need, identified at national, regional and international level, of reinforcing One Health systems by leveraging on lessons learned emerging from studies and activities implemented in multiple contexts and with the collaboration of several stakeholders.

In the context of MLS, during these ten years of activities, all the involved Institutions did an extensive effort, which allowed the strengthening of all the sectors involved and ensured, at the same time, multisectoral collaboration and synergies to move towards the disruption of silos and consolidation of integrated systems.

This effort has highlighted that some implementation strategies are valuable and efficacious in facilitating the adoption of the One Health approach at national level and should be promoted with policy makers in order to ensure changes also at governance level.

In line with the mission of our Institute, the aim of the National Centre for Global Health in drafting this document was to translate the lessons learned during MLS in actionable recommendations for integrated policy development, to strengthen prevention and preparedness to health threats.

We are glad to acknowledge the contribution of all the partners involved and of the external scientific board who helped to make the strategic document more exhaustive, coherent and contextualised.

Although aware of the limitations that this document may present, we are confident that it can represent a further step forward towards the operationalization of One Health and the strengthening of One Health systems in our countries.

The Institute intends to continue to make its contribution towards this end.

Prof. Rocco Bellantone
President
Istituto Superiore di Sanità

PROLOGUE

The National Centre for Global Health of the Istituto Superiore di Sanità (ISS, the National Institute of Health in Italy) started to collaborate with the countries of the Mediterranean Basin and Middle East in 2006 within the EpiSouth Network.

Working with a network of countries is quite challenging, since common objectives and agreed priorities should be set considering also the different contexts of the countries involved.

With the MediLabSecure (MLS) Project this complexity increased.

In fact, the objective of MLS is to contrast arbovirus infections with a One Health (OH) approach, therefore, in addition to the involvement of the Public Health Institutes (as in EpiSouth), all the reference laboratories and institutes supporting vector-borne diseases control from 22 countries across Europe, Middle East and Africa, have been involved.

Different sectors and disciplines relevant for arboviruses surveillance, preparedness and response are involved in the project: human and animal virology, medical entomology, public health & veterinary services.

The activities performed during the project have provided numerous reflections to enhance OH operationalisation at national and cross-country level, and therefore these lessons learnt are considered in this document to provide suggestions to strengthen OH systems.

The ISS team has leveraged these lessons learned to contribute to other research initiatives aimed at strengthening OH operationalisation, such as the development of adequate competencies for the workforce involved in OH strategies and the identification of enabling factors facilitating the strengthening of national OH systems.

We hope, therefore, that the lessons learned reported in this document could support the supranational and national institutions within the MLS Network and beyond in their journey to strengthen OH systems.

The editors

INTRODUCTION

Vector-Borne Diseases (VBDs) account for more than 17% of all infectious diseases, causing more than 700,000 deaths annually worldwide and devastating socio-economic consequences (1). Climate, environmental and global changes, such as urbanization, trade, travels, and close interactions with livestock have been linked with the emergence and/or re-emergence of VBDs (2). Multidimensional determinants of VBDs demand holistic approaches, such as One Health (OH), which considers socio-ecological determinants and promotes multisectoral and multistakeholder collaboration (3).

MediLabSecure (MLS) is an EU-funded project that aims at strengthening the capacities necessary to face and reduce emerging biological risks in the Mediterranean, Sahel, Black Sea and Balkan regions (https://www.medilabsecure.com/). More specifically, the project focuses on risks related to VBDs and especially arboviral diseases, caused by viruses transmitted to people by the bite of infected arthropods. The project was implemented in two phases (2014-2018 and 2019-2024). The first phase was mainly focussed on strengthening surveillance of arbovirus infections with a OH approach, while the second one aimed at reinforcing comprehensively the OH prevention, preparedness and response system at national level.

Capitalizing on the MLS Network established in 2014, involving national reference laboratories and public health institutions (Appendix A) from 22 countries (Figure 1), the purpose of the MLS second project's phase was to provide capacity building and networking activities for:

- strengthening and harmonizing preparedness and response capacities to health threats, mainly vector-borne viruses and their vectors, in the target regions;
- enhancing awareness of the added value of integrated surveillance, risk assessment and early warning to prevent and control epidemics;
- promoting institutional adoption of OH and consolidation of the OH workforce.

The MLS Network activities were led by a consortium of six European institutions of different expertise:

- Institut Pasteur (France):
  - Department of International Affairs: *coordination and communication* of the project;
  - Emergency Cell for Biological Intervention: *human virology expertise*;
- Centro de Investigación en Sanidad Animal, Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria - Consejo Superior de Investigaciones Científicas (CISA-INIA, CSIC) (Spain): *animal virology expertise*;
- Institut de Recherche pour le Developpement (IRD) (France): *medical entomology expertise*;
- Istituto Superiore di Sanità (ISS, National Institute of Health) (Italy): *public health expertise*;
- Istituto Zooprofilattico Sperimentale dell'Abruzzo e del Molise "G. Caporale" (IZS-Teramo): *veterinary expertise*;
- Avia-GIS (Belgium): *Spatial Modelling & Disease Management expertise*.

This last phase of MLS ended in November 2024 and included the working packages represented in Figure 2.

Further details related to MLS Project are available at its website which includes project's achievements, reports of activities and publications.

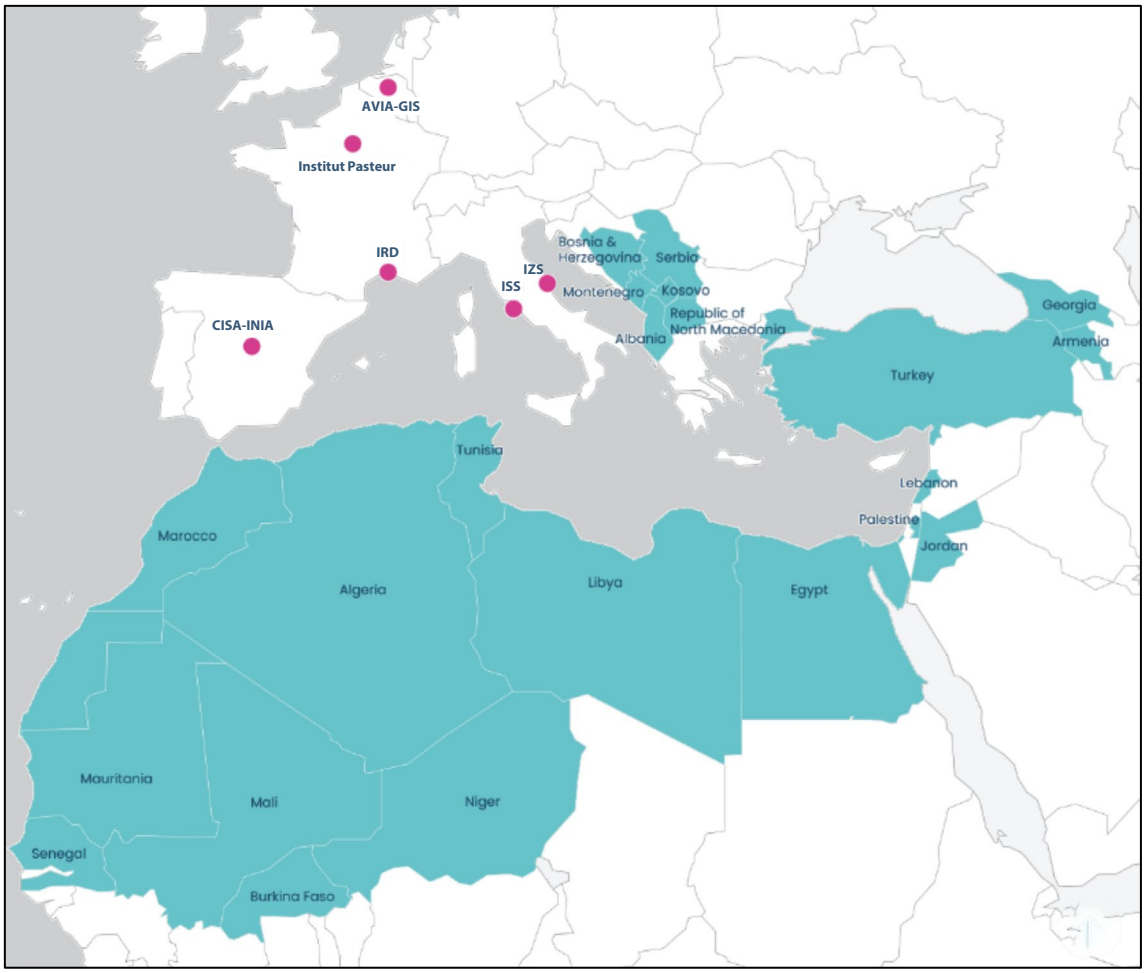


Figure 1. MLS Network: the 22 countries members (in blue) and partners (pink dots)

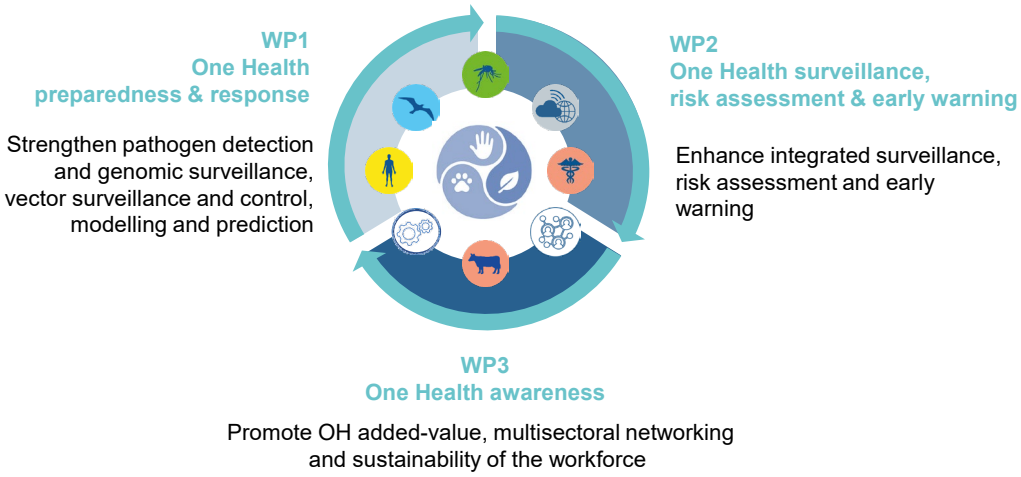


Figure 2. Work packages of th 2nd phase of the MLS Project (2019-2024)

AIM AND SCOPE OF THE STRATEGIC DOCUMENT

This strategic document is the second one developed in the context of the European MLS Project which has now reached a total duration of ten years (2014-2024).

The aim is to highlight relevant lessons learnt emerged during the implementation of the activities (including laboratory training, exercises, assessments, operational studies, etc.), to share actionable recommendations with the project's stakeholders. In the first document published in 2018, "Integrated surveillance and risk assessment for arbovirus infections: recommendations for enhancing One Health in the Mediterranean Region" (*Rapporto ISTISAN* 18/20) (4), the results and lessons learnt from the operational studies and activities implemented in the first four years of MLS were discussed.

With the support of a scientific board, we were able to identify specific recommendations for strengthening integrated surveillance and risk assessment for arbovirus infections in the MLS countries.

Since 2019, MLS has endured its efforts aimed at adopting and operationalizing OH approaches in national prevention and preparedness strategies through capacity building activities, such as trainings and implementation of operational studies through stakeholders' engagement.

In the regions targeted by the project, as well as in other regions, there is the need to strengthen the national OH systems, which involve all the activities and actors that work to prevent, prepare and respond to health threats in a coordinated way. This implies radical changes in key areas such as governance (intersectoral collaboration), distribution of resources, data collection and sharing, and training.

With our colleagues from the 22 countries of the MLS Network, we have tried to address these challenges with operational studies, exercises and training whose main features are reported and discussed in this strategic document.

This document should not be intended as a Project report, describing activities, achievements and constraints; rather, it intends to discuss the strategies adopted by MLS to enhance OH operationalization and the lessons learnt that could be considered for future strategies in the regions emerged from specific activities which were particularly relevant for supporting integration of OH approaches in national strategy.

It could be therefore a contribution to the supranational and national institutions in charge for strengthening OH operationalization and to MLS members who are in the journey to strengthen their OH national systems.

An executive summary highlighting the main aspects of this strategic document is provided in Appendix B.

ONE HEALTH OPERATIONALIZATION

The international and scientific community has been calling over several decades to strengthen prevention and preparedness to VBDs and zoonotic diseases by integrating a systemic approach, such as the OH approach (5, 6). The recently established One Health High Level Expert Panel (OHHLEP) defined the OH approach as an integrated, unifying approach that aims to achieve optimal and sustainable health outcomes for people, animals, plants and the environment by mobilizing multiple sectors, disciplines and communities (Figure 3) (7).

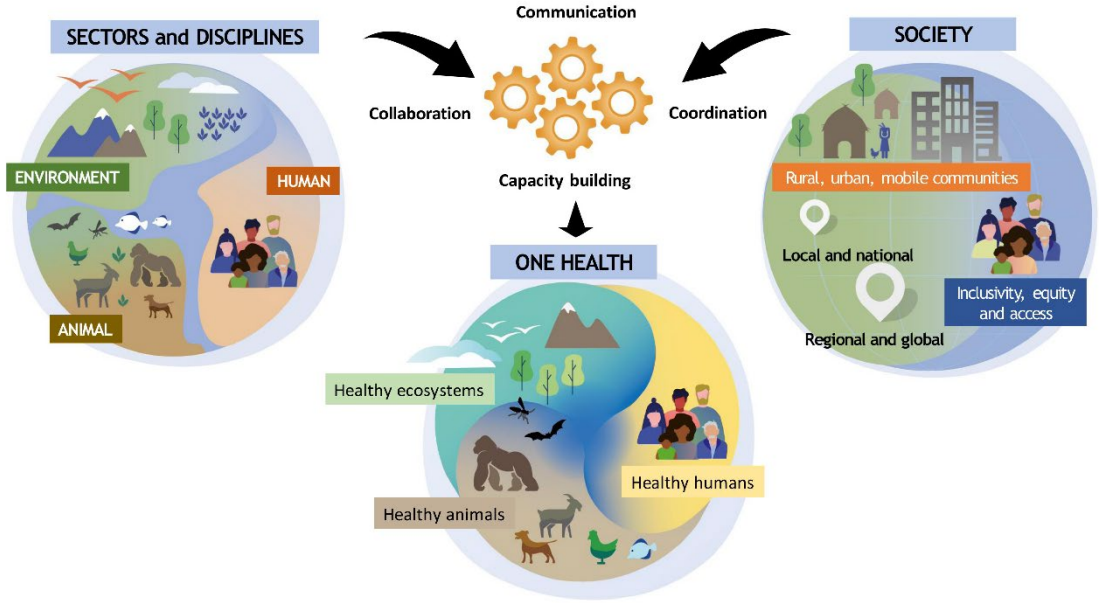


Figure 3. OH representation by the OHHLEP (7)

However, operationalization and implementation of the OH approach are challenging, in particular where inequality and insecurity are predominant (8).

The Quadripartite Organizations – the Food and Agriculture Organization of the United Nations (FAO), the United Nations Environment Programme (UNEP), the World Organisation for Animal Health (WOAH, founded as OIE), and the World Health Organization (WHO) –, responding to international requests to prevent future pandemics and to promote health sustainably through the OH approach, have developed the OH Joint Plan of Action (2022-2026) (OH JPA) (9) and its guide to collectively advocate and support the operationalization and implementation of OH.

Within the framework of the MLS Project and with the support of Country Members Institutions, capacity building activities were delivered to promote OH operationalization and finally contribute to strengthen national OH systems.

BUILDING CAPACITIES TO STRENGTHEN OH SYSTEM IN THE MLS NETWORK

Since the first phase of implementation of MLS Project (2014-2018), the capacity building strategy was carefully discussed and designed based on specific OH principles.

In accordance with the definition provided in 2010 at the Conference entitled *"*Operationalizing One Health: a policy perspective – taking stock and shaping an implementation roadmap*"* (10), OH is an approach of improving health and well-being through the prevention of risk and the mitigation of effects of crises (e.g., emerging diseases) that originate at the interface between humans, animals and their various environments.

The desired impact of the OH approach expected through intersectoral integration can only be achieved if also the capacities of each involved sector are sufficiently strong and developed (11).

In line with this vision, MLS adopted a comprehensive strategy including capacity building activities aimed at strengthening each of the sectors involved (public health, human and veterinary virology, animal health, entomology) and intersectoral activities aimed at promoting and strengthening integration between sectors (multisectoral risk assessments exercises; multisectoral situation analysis studies; etc.).

The focus of the strategy during the first phase of the project was on improving OH surveillance and risk assessment of arbovirus infections by enhancing laboratory capacities and promoting multisectoral activities. This strategic approach provided valuable progresses at country level and therefore with the starting of the new phase in 2019, this capacity building strategy was again adopted but with an extended focus, to facilitate not only the reinforcement of the surveillance and risk assessment, but to promote the entire OH system development at national level (Figure 4).

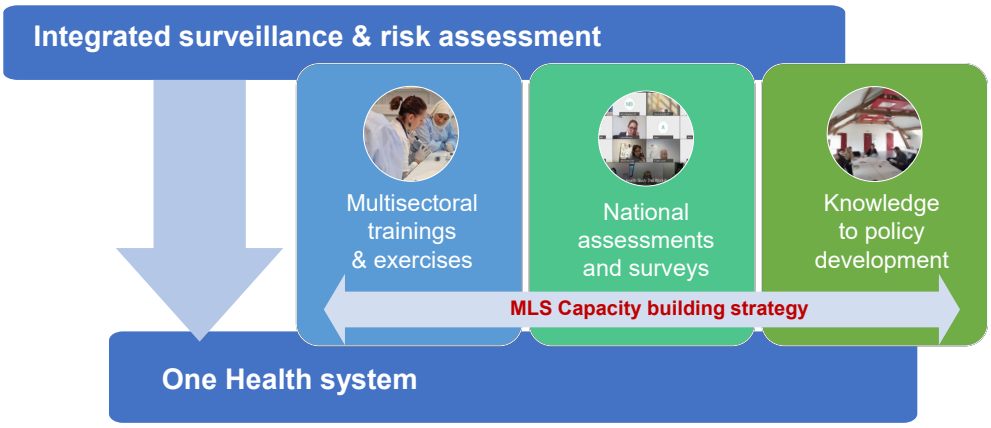


Figure 4. Capacity building strategy of the 2nd phase of the MLS Project: from the surveillance and risk assessment to the OH system

As it will be described in the next chapters, an effort has been done to implement trainings addressing surveillance-related topics in an integrated way and involving network's members from more than one sector, to assess national OH systems also in terms of governance, and to facilitate translation of evidence in recommendations for OH policies.

The activities implemented have produced some lessons learned which will be highlighted in the next paragraphs. In particular, it was decided to focus on some of the MLS activities to illustrate how the project addressed emerging challenges to prevention and preparedness strategies, promote intersectoral connection and contribute to increase the awareness of the added value of OH in coping with these challenges.

Multisectoral training and exercises: enhancing awareness and capacities for integrated actions

Metagenomics training program

In brief

A training curriculum in three phases (introductory webinar + hands-on workshops + external quality assessment) was organized to improve the capacities of professionals from human virology, animal virology and entomology sectors on the use of metagenomics technologies for the diagnosis of infectious diseases.

Lessons learned

The results obtained in the external quality assessment exercise were excellent with more than 90% of the participating labs obtaining 100% correct results. This training was highly beneficial to improve genomic surveillance capacities of human, veterinary and entomology laboratories and building up cooperation links between and within sectors and countries and to explore potential avenues for collaboration to be consolidated in national plans.

Metagenomics is an exceptional tool to detect and characterize pathogens in the context of outbreaks and epidemics, with unlimited applications in all fields of biology, particularly in virology. Although it emerged in the last decades, the interest in metagenomics technologies has increased tremendously in the last years, especially since the beginning of the SARS-CoV-2 pandemic that highlighted the importance of genomic surveillance for efficient preparedness and response to epidemics. The MLS coordinators of human and animal virology MLS teams decided to implement a training curriculum in three phases targeting medical and veterinary laboratories, and medical entomologists utilising Next-Generation Sequencing technologies.

The general purpose of the workshops was the acquisition of essential knowledge (theoretical and practical) of metagenomics technologies and their applications in the field of infectious diseases for the different sectors involved.

The last step of this training curriculum was the organization of an External Quality Assessment (EQA), to evaluate the acquired capacities of each laboratory during the workshops. Nineteen laboratories from the 3 involved sectors participated and more than 90% of them correctly identified the etiological agent present in the samples.

This training was highly beneficial to improve diagnostic laboratory capacities of human, veterinary and entomology laboratories and building up cooperation links between and within sectors and countries and to explore potential avenues for collaboration.

Training on urban vector mapping

In brief

A training course was organized to equip entomologists from the Balkan, Black Sea, and Mediterranean regions with essential tools for mapping mosquito distribution in urban areas. The training was conducted in two phases: an initial week of fieldwork to familiarize participants with the software VECMAP, followed by six weeks of online training to enable them to develop a greater autonomy in the use of mapping tools, specifically the VECMAP platform and QGIS, an open-source geographic information system.

Lessons learned

The training helped to raise awareness of entomologists about the important role of the urban environment in transmitting arbovirus infections and about the importance of considering urban health in the development of OH Arbovirus prevention measures and policies.

The aim of the training was to gain a better understanding of the characteristics of *Aedes* hotspots in cities in order to implement control plans and train entomologists about urban vector ecology and mapping.

This perspective implies being able to monitor *Aedes* population dynamics using various tools (human captures, ovitraps, identification of breeding sites), identify captured species and then map them, using VECMAP, a software package developed by AVIA-GIS and QGIS, an open-source geographic information system.

The first part of the urban vector mapping training course took place in Tirana, Albania, from September 4 to 8, 2023 for 12 entomologists from the Balkan and Black Sea region (Figures 5 and 6).

Figure 5. Mosquito identification session of MLS urban vector mapping training course in Tirana (2023)

Figure 6. Field data collection with VECMAP in Tirana (2023)

The second part consisted of distance learning on the VECMAP platform over the following 6 weeks. During the first part, learners went out into the field at the end of the day to collect mosquitoes (adults, eggs, larvae) in different urban areas, using different tools (aspirators, dippers, etc.).

At the same time, they learned to use the VECMAP mobile application to locate collection sites and gather information on the environment around the collection sites.

For the online training, four sessions were organized, consisting of basic GIS training using QGIS software.

The training allowed entomologists to increase their knowledge of urban health for entomological control in order to apply it within OH Arbovirus prevention measures and policies.

A 2nd training was organized in Tunisia dedicated to 16 entomologists from Algeria, Burkina Faso, Lebanon, Libya, Mauritania, Morocco, Senegal, and Tunisia. The online part of this training took part from 7 to 31 October 2024 (Figure 7).

Figure 7. MLS Field session of urban vector mapping training course in Tunisia (2024)

Multisectoral risk assessment exercise in Senegal

In brief

A multisectoral risk assessment (MRA) exercise on Rift Valley Fever Virus (RVFV) has been conducted with the MLS countries of the Sahel and Maghreb regions.

Lessons learned

Relying on the country members who had already participated in the previous MRA exercises (ToT approach) facilitated the exercise development and implementation.
Multisectoral representation facilitated a comprehensive understanding of the exercise, of the role of each sector involved and a more effective risk assessment.
The participation of the WHO regional representatives in the exercise promoted the organisation of further exercises on the basis of this experience.

The 4th Multisectoral Risk Assessment (MRA)[2] Exercise was designed about Rift Valley Fever Virus (RVFV) surveillance in the Sahel and Maghreb Regions to assess the level of risk at country level with the support of a methodology applied by FAO for the Risk Assessment for RVFV in Niger (March 2017) (12).

[2] Multisectoral Risk Assessment (MRA): assessment with the concomitant participation of all the relevant sectors involved in the surveillance of a given pathogen.

It was implemented in Dakar on the 21st of January 2020, in the framework of the MLS Regional Meeting (20-24 January) (Figure 8).

Figure 8. Activities of the MLS MRA in Senegal (2020)

The first three multisectoral exercises were implemented in 2015 in Paris focusing on West Nile Virus (WNV), in 2016 in Belgrade focusing on Crimean Congo Haemorrhagic Fever Virus (CCHFV), in 2017 in Tunis focusing on RVFV.

MLS has implemented MRA exercises either involving all the countries of the Network, or only those belonging to a specific region (13).

The exercise in Dakar involved country participants and external experts, for the overall number of 29 participants and 14 facilitators, from the following areas of expertise: entomology (n. 11), human virology (n. 9), public health (n. 9), animal virology (n. 8), veterinary services (n. 5), GIS (n. 1).

The countries were divided in two groups on the basis of their epidemiological situation for RVFV. Some aspects have been considered critical to assess the level of risk: adequacy of preparedness measures, epidemiological situation of RVF/RVFV in the neighbouring countries; procedures/laws for animal movements.

A Training-of-Trainers (ToT) approach was adopted aimed at consolidating capacities and support sustainability: four MLS Focal Points who had already taken part in the previous MRA Exercise on RVFV in Tunis (July 2017) were involved in the development of the new exercise and as facilitators during its execution. They were able to reply correctly to all the pre-test questions, unlike one third of the participants.

Multi-sectoral representation, as emerged also from the previous MRA held in Tunis, helped to frame more rapidly the situation in the country and facilitate a comprehensive risk assessment. The results of the pre and post-tests highlighted the usefulness of these exercises to raise awareness on neglected risk factors (i.e., climate changes or social instability).

Integrated surveillance exercise for Crimean-Congo Haemorrhagic Fever Virus in the Balkans and Black Sea Region

In brief

An exercise on integrated surveillance for Crimean-Congo Haemorrhagic Fever Virus (CCHFV) was performed at the Balkan and Black Sea Regional Meeting in March 2023 in Montenegro as a follow-up of the exercise done in Serbia in 2016.

Lessons learned

Countries could describe their integrated CCHFV surveillance system if already available in their own country, or they designed one with a OH perspective if not yet available in their own country, and they outlined strengths and challenges. The information collected in the context of the organisation and implementation of the exercise allowed to assess the progresses made by the involved countries in relation to integrated surveillance for CCHFV.

A multisectoral exercise for the integrated surveillance of CCHFV was organized and implemented in March 2023 at the regional meeting in Montenegro with the aim of assessing improvements in the Balkans and Black Sea Region. The information gathered during this exercise were compared with those collected in a similar exercise done in Serbia in 2016.

In addition, interviews were conducted with representatives from Serbia, Türkiye, and Georgia to gain a deeper understanding of CCHFV integrated surveillance in these countries.

Since 2016, improvements have been observed in CCHFV surveillance. Previously, many countries lacked surveillance systems, in 2023 six out of nine have surveillance in each of the relevant sectors for CCHFV and an additional country has consolidated the entomological surveillance (Figure 9). The six countries with CCHFV surveillance in the three sectors have also reported transversal interaction between the systems in terms of data exchange and analysis.

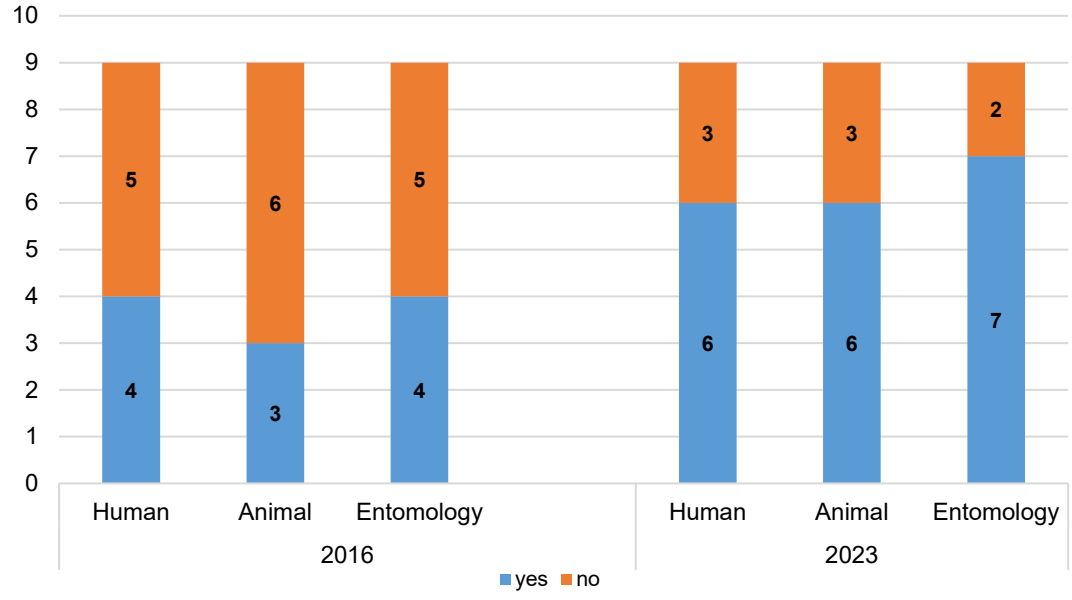


Figure 9. Active CCHFV surveillance system situation in the human, animal and entomology sectors of in 2016 and 2023

Integrated prevention and response strategies for CCHF

After 2016, as per the information collected, Armenia, Serbia, Bosnia-Herzegovina, and Montenegro are reinforcing prevention strategies by focusing on data collection, effective governance, cross-border collaborations, and capacity building.

In Bosnia-Herzegovina, seroprevalence testing on ticks, sheep, and cattle monitors potential CCHF vectors and hosts, while Armenia has developed detailed maps of Ixodes ticks' distribution.

These data collection initiatives provide a solid foundation for informed decision-making. Capacity building is also essential; for instance, Serbia conducts annual OH training sessions involving multiple sectors.

Cross-border collaborations, like Armenia's formalized partnerships with neighbouring countries and Serbia's cooperation with North Macedonia, further enhance preventive strategies.

In terms of response strategies, countries like Georgia, Türkiye, Albania, Kosovo, and North Macedonia have structured approaches to manage disease outbreaks. Standard operating procedures ensure coordinated efforts across human and veterinary sectors.

In Türkiye, meetings between the Ministry of Health and the Ministry of Agriculture determine strategies based on previous outbreak data, and public awareness campaigns are conducted in villages. Comprehensive seroprevalence studies in ticks and livestock are also conducted in Albania and Georgia.

Capacity building remains a priority, with countries focusing on personnel training before each disease season, extending to community engagement when resources permit. Cross-border collaboration, such as the close cooperation between Georgia and Türkiye, ensures a coordinated response to disease threats.

Two countries (Georgia and Serbia) have established a national OH centre and this seems to facilitate the integration at national level.

In Table 1 the main challenges faced by the countries reported during the exercise are summarised.

Table 1. Challenges identified during Montenegro's exercise for the implementation of OH approach

Area	Identified challenges
Governance	Lack of allocated funds for the implementation of an integrated approach
Capacity building	Need for training programs with an integrated perspective for the personnel
	Deficiency of educational programs for the community
Data collection	Lack of integration of the environmental sector in data collection

National assessments and surveys: describing local system to identify needs and gaps of the OH systems

One Health MLS situation analysis

In brief

Three assessments were carried out to describe the national OH systems in Armenia, Montenegro and Bosnia & Herzegovina with the support of a One Health Conceptual Framework.

Lessons learned

The assessments helped to raise the awareness of the involved national institutions about the strengths and gaps of the national OH system and facilitate the development of a road map to implement feasible actions to strengthen it.

A first step to strengthen OH national systems would be to assess the level and characteristics of OH national operationalization.

In the context of the MLS Projects, the ISS Public Health team, in collaboration with the experts of the relevant national institutions, implemented the OH MLS Situation Analysis studies (OHMeSA).

During the first phase of MLS the OHMeSA studies were conducted in Serbia, Tunisia and Georgia, during the second phase in Armenia, Montenegro and Bosnia & Herzegovina (14-16).

The aim was to describe the situation in terms of OH implementation in the Mediterranean and Black Sea regions of MLS (Figure 10).

Figure 10. Countries involved in the 1st (in red) and 2nd phase (in blue) of the MLS Project

The OHMeSA study included an action-oriented situation analysis aimed at assessing the level of integration among different sectors and stakeholders for the prevention and preparedness to threats at the human-animal-environment interface, such as Arboviruses and zoonoses.

The specific objectives of the OHMeSA studies were:

– to describe relevant sectors and stakeholders engaged in OH activities at national level.
– to identify priority health threats that could benefit from the OH approach and use the prioritized health threats as case studies to assess the integration of OH approaches in prevention and preparedness strategies at national level.
– to enhance awareness of the stakeholders about the importance of multisectoral and multidisciplinary collaboration.

Considering that national resources are always limited, these kind of assessment exercises conducted with national stakeholders help to identify OH strategies which could address threats that can benefit from multisectoriality, and from allocation of resources in agreement with roles and priorities.

The study was implemented as per the progressive steps reported in Figure 11.

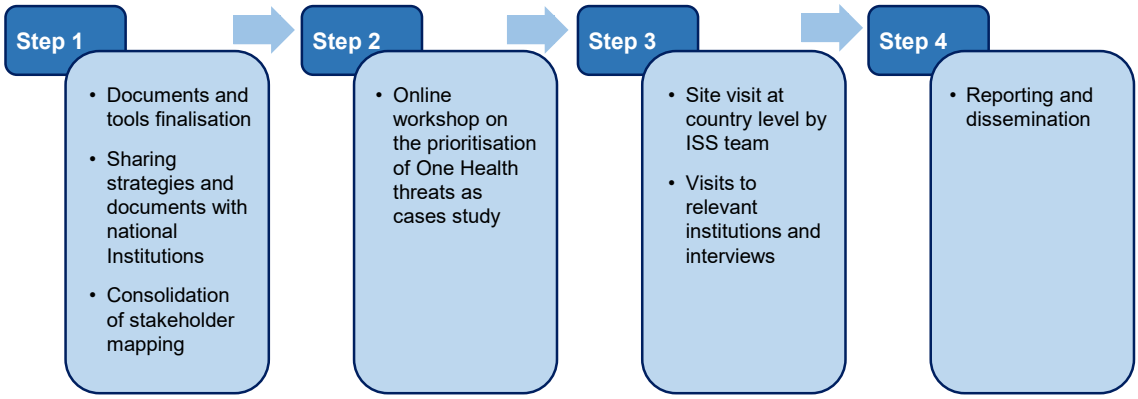


Figure 11. OHMeSA studies steps

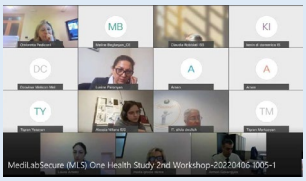
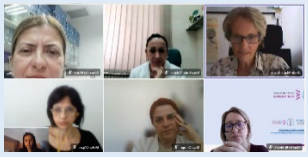
The prioritisation for selecting two threats relevant for the countries was based on the indicators reported in the Box 1.

BOX 1. Indicators used for the prioritization of OH threats during the OHMeSA studies

- Threat detected or caused outbreaks /epidemics in the past ten years
- Threat detected in a new location or population in the country or neighboring countries in the past ten years
- Threat whose animal host (domestic or wild) is/are in close proximity to humans
- Threat whose related vector/s' presence and abundance are increasing due to anthropogenic, climatic, and environmental factors
- Threat affecting food safety and /or food security
- Threat impacting greatly socio-economic aspects in case of outbreak
- Threat benefitting the most from the integration of OH in preparedness/surveillance/response
- Threat for whom a OH preparedness /surveillance plan is available
- Threat benefitting the most from the integration of environmental and climatic data in its / their surveillance
- Threat which has activated a recent response action to contain a potential outbreak of the disease
- Threat with an integrated data collection and analysis system

Table 2 reports the main aspects characterising the three studies and lessons learned.

Table 2. Features of the study in the three countries involved in the 2nd phase of the MedLabSecure Project

Country	Implementation period	Methodology	Prioritised pathogens	International organisations involved
Armenia 	November 2021-June 2022	online workshops (site visit not feasible due to COVID-19 pandemic restrictions)	Crimean Congo Haemorrhagic Fever Virus and Anthrax	WHO
Montenegro 	May-September 2023	Hybrid format: online workshops & site visit	West Nile Fever Virus and Leishmania	WHO
Bosnia&Herzegovina 	July-November 2024	Hybrid format: online workshops & site visit	West Nile Fever Virus and Brucella	WHO, UNEP, ECDC

The studies highlighted the following aspects which have facilitated the implementation of the assessments and the identification of recurrent features of the OH national systems:

- The presence of sensitised MLS country Focal Points allowed the smooth implementation of the study and supported the identification and inclusion of all the relevant actors in the stakeholder mapping.
- The fact that the involved Institutions have been part of the MLS Project since 2014 increased their awareness about the OH approach, and stakeholder participation in the workshops was constant and active.
- The assessment helped to describe the situation in terms of strengths and needs of the OH national system and to identify actions to further strengthen it.
- The assessment highlighted that the environmental and socio-economic sectors were rarely involved in the actual development of prevention and preparedness actions.
- The assessment was also an opportunity for the representatives of the different sectors to share their concerns regarding current outbreaks and the need to find common resources and procedures to ensure the accomplishment of all the activities needed to prevent further outbreaks.
- MLS countries realised that the OH approach is mainly integrated during response to outbreaks and attention is needed in integrating OH in prevention and preparedness.
- The participation in the assessments of international organisations allowed alignment with international plans and enhanced dissemination of MLS activities.

Survey on the involvement of veterinary laboratories in the COVID-19 crisis

In brief

To evaluate the involvement of MLS animal virology laboratories in the COVID-19 crisis and estimate the extent of intersectoral collaborations during the pandemic, an online survey was launched in April 2021 addressing all the vet labs in the network.

Lessons learned

The survey revealed that most of veterinary labs in the MLS Network were able to quickly adapt their resources and personnel to effectively respond to a public health emergency in collaboration with human virology labs. However, in some cases, well-equipped and trained animal labs were not utilized to their full potential due to a lack of consolidated OH connections. The survey showed that previous intersectoral cooperation in the context of other zoonotic diseases significantly increased the ability of laboratories to successfully coordinate to establish a reliable diagnostic partnership.

The involvement of veterinary laboratories in the COVID-19 pandemic highlighted the significance of the OH approach in prevention and preparedness strategies. The pandemic offered a unique opportunity to illustrate the vital role that veterinary professionals play in addressing global health challenges and the importance of fostering better cross-sector collaboration to prepare for future health emergencies.

To evaluate the involvement of MLS animal virology laboratories in the COVID-19 crisis and estimate the extent of intersectoral collaborations, the animal virology coordination team (INIA-CSIC) launched an online survey in April 2021.

They received responses from 20 labs across 19 countries. Among these, 60% (n. 12) engaged in SARS-CoV-2 diagnostics in humans and/or animals (Figure 12). Of those, 8 animal labs established fruitful intersectoral cooperation, playing a crucial role in PCR (Polymerase Chain Reaction) testing of human samples. This collaboration was pivotal to increase the diagnostic capacities of the countries, especially when reference human labs were completely overwhelmed in the early stages of the pandemic.

Based on the responses of the veterinary laboratories that did not establish this cooperation, the main reason was that their respective Ministries of Health did not request their assistance, despite having the expertise and capacities and offering their support. In some cases, this collaboration was not possible because vet labs were not authorized to manipulate human samples. Notably, out of the 8 vet labs that were not directly involved in diagnosis, 5 provided substantial support to public health institutions by other means like lending of thermocyclers and other laboratory equipment or the donation of reagents, kits and personal protective equipment.

It is worth noting that for 62.5% of the veterinary laboratories this was their first experience in human diagnosis. Only three of them had previously collaborated with human labs in the diagnosis of other zoonotic diseases like brucellosis, leptospirosis and West Nile Fever.

Beyond molecular diagnosis, vet labs in the network partnered with public health institutions in other crucial ways including premises decontamination, sequencing of positive human samples, research studies on disinfectant efficacy, participation in national COVID-19 committees, etc.

In conclusion, the survey revealed that veterinary laboratories were able to quickly adapt their resources and personnel to effectively respond to a public health emergency. Although for most of the veterinary laboratories this was the first time analysing human samples, the collaboration with public health authorities was generally successful, and the cross-sectoral experience was recognized as highly beneficial in all the countries.

Previous intersectoral cooperation in the context of other zoonotic diseases significantly increased the ability of laboratories to coordinate and quickly establish a reliable diagnostic partnership.

Figure 12. Diagnosis of SARS-CoV-2 in human samples carried out in a veterinary laboratory during the first phase of the pandemic (2020)

Online survey and operational research on how to engage multiple sectors and communities for prevention and preparedness

In brief

To explore enabling factors and extent of multisectoral community-based systems for VBDs prevention and preparedness within the MLS Network the public health MLS team performed operational research including a survey, a questionnaire session and a rapid literature review.

Lessons learned

The enabling factors described could guide decision-makers of the MLS Network to create a multisectoral, multilevel and multigroup governance when designing and implementing OH interventions for VBDs prevention and preparedness including communities.

In 2017, the WHO adopted the Global Vector Control Response (GVCR) 2017-2030 as a new advocacy strategy to reduce the burden of VBDs, that include inter-sectoral collaboration and community engagement, as fundamental pillars (17).

To explore enabling factors for multisectoral community-based systems for VBDs prevention and preparedness a two-way approach was adopted based on a literature review and questionnaire with members of the MLS Network. Around 100 MLS Focal Points and 100 members of the MLS Network 22 countries were contacted through email to reply to an online survey and 62 (at least one per each country) answered the survey's questions.

The presence of community-based systems for VBDs prevention and preparedness was acknowledged by 37% of respondents, mainly targeting WNV (27%), CCHFV (22%) and RVFV (14%). The most represented sectors within the community systems were entomology (31%), followed by human health (30%) and animal health (28%) and the collaboration of at least two sectors was acknowledged by 40% of participants.

A session during the Balkan and Black Sea Regional Meeting in March 2023 was organized to collect further information.

On the other side, a systematic rapid literature review was therefore performed to explore successful examples of multisectoral community-based systems for VBDs prevention and preparedness in the literature and expert consultations were organized to refine the results and highlight how coordination and collaboration across sectors and stakeholders could be implemented in a multilevel dimension.

The review highlighted that collaboration and coordination of different sectors and stakeholders allowed to focus resources and improve effectiveness of the interventions, and share knowledge and perspectives. The main enabling factor for successful VBDs prevention and preparedness community-based systems was the creation of synergies between actors, sectors, resources, strategies and data, that allowed to target multidimensional drivers of VBDs, supported transversal capacity building, and a holistic monitoring evaluation and improved effectiveness and sustainability. To support coordination and collaboration among the stakeholders, including communities, mechanisms for interaction were created, such as working groups and committees, and connection agents, local leaders with strong relationships with the institutional and community systems, emerged as the main enabling factor for a multilevel governance and to engage communities and institutional stakeholders (18).

Knowledge to policy development

Policy brief training

In brief

Ensuring that the research findings are accessible to decision-makers is a prerequisite for integrating this knowledge into national and international health plans. Learning how to write policy briefs, and defining their content according to whom they are intended for, is essential.

Lessons learned

Over 80% of participants had no experience of writing policy briefs. The training allowed developing capacities for knowledge dissemination between the different stakeholders involved in the OH system.

It is widely acknowledged that to prevent vector-borne diseases, it is essential to rely on scientific findings to implement appropriate control measures. Despite this, it is often very challenging for a non-scientist to access these scientific data. It is therefore crucial

that scientists can translate their results into key information for stakeholders so that they can make the best decisions to control and prevent vector-borne diseases.

A policy brief writing training was proposed to bridge the communication gap between scientists and stakeholders in the beneficiary countries of the MLS Network. This training took place in Sète, France, from October 24 to 26, 2023. It was organized by the entomology sector of MLS in collaboration with two policy brief experts. This training was open to all beneficiaries of the MLS Network to provide them with the basics of policy brief writing. The selected learners had previously completed the MOOC (Massive Open Online Courses) developed by the University of Montreal and obtained their certification. They were then invited to participate in a 3-day in-person training to produce a policy note based on their own scientific data (Figure 13).

Figure 13. Discussion around data to be transmitted to stakeholders during the MLS Policy brief training (2023)

Fourteen trainees represented eleven nationalities, from Albania, Algeria, Armenia, Burkina Faso, Georgia (n. 2), Lebanon, Morocco, Senegal (n. 2), Serbia (n. 2), Tunisia and Türkiye were present for the training. They were identified by the Focal Point of the MLS beneficiary countries among all the sectors (medical entomology, public health, animal health, human virology and animal virology).

Over 80% of participants had no experience of writing policy briefs. The majority appreciated the training (94%) and 75% said they had learned a lot from it. The majority of participants (80%) said they felt confident writing a policy brief, and 56% intended to do so.

Multisectoral knowledge to policy translation exercise

In brief

This exercise was performed during the MLS Global Meeting to create awareness about the need to adopt the OH approach during the process of knowledge translation. Multisectoral and multi-country working groups elaborated on one of the recommendations of the MLS strategic document (draft version) to co-develop a short oral communication to convince decision-makers to prioritize their evidence.

Lessons learned

The participants reported that the exercise was a useful opportunity for multisectoral and multi-country exchange and that more training and exercises about multisectoral knowledge to policy translation need to be performed online and at country level to increase awareness and capacities in this area. Some MLS countries reported the intention to implement similar trainings at national level.

This exercise was performed on the 13th of June 2024 during the MLS Global Meeting in Paris to create awareness about the need to adopt the OH approach during the process of knowledge translation and as an opportunity for the members from different sectors and different countries to work together and identify solutions to challenges that might arise when working in a multisectoral and multi-country group.

Decision-makers have to translate solid evidence into policies and programs. In this process the researchers have a critical role to ensure that the evidence is well understood by the decision-makers in a process called knowledge translation. The OH approach promotes collaboration between different sectors, therefore also the knowledge translation process has to include the outcomes, needs and perspectives of all the different sectors and provide a clear and coherent message to the decision-makers.

The exercise was based on the creation of multisectoral and multi-country working groups that elaborated on one of the recommendations of the MLS strategic document (draft version) to co-develop a short oral communication to convince decision-makers to prioritize their evidence during the agenda setting step of the policy cycle (Figure 14).

The exercise started with an introductory lecture about multisectoral knowledge translation which included a video. After an overview of the exercise the participants were invited to join their working groups and were supported by a facilitator to produce their oral communication. The restitution in plenary, included a role -playing simulation with a rapporteur from each group having a few minutes to convene the communication to a decision-maker (a facilitator from a different group).

Each participant received a printed guidance, and the facilitators received the specific guidance in advance.

The pre- and post-tests showed that the majority of the participants (61%) had not participated in any knowledge translation activities before and that the exercise generally improved the awareness of participants about multisectoral knowledge to policy translation (the percentage of participants who rated their understanding of the importance of multisectoral knowledge to policy translation as “Good” or “Very good” increased from 44% to 84% in the post-test).

The enablers of multisectoral knowledge to policy translation were outlined as effective communication and coordination between sectors, adequate resources and training, and the challenges as lack of funding, poor coordination and communication and political will.

The participants reported that the exercise was a useful opportunity for multisectoral and multi-country exchange and that more training and exercises about multisectoral knowledge to policy translation need to be performed online and at country level to increase awareness and

capacities in this area. Moreover, it was suggested that tools, protocols and case studies about multisectoral knowledge to policy translation would need to be developed for member countries.

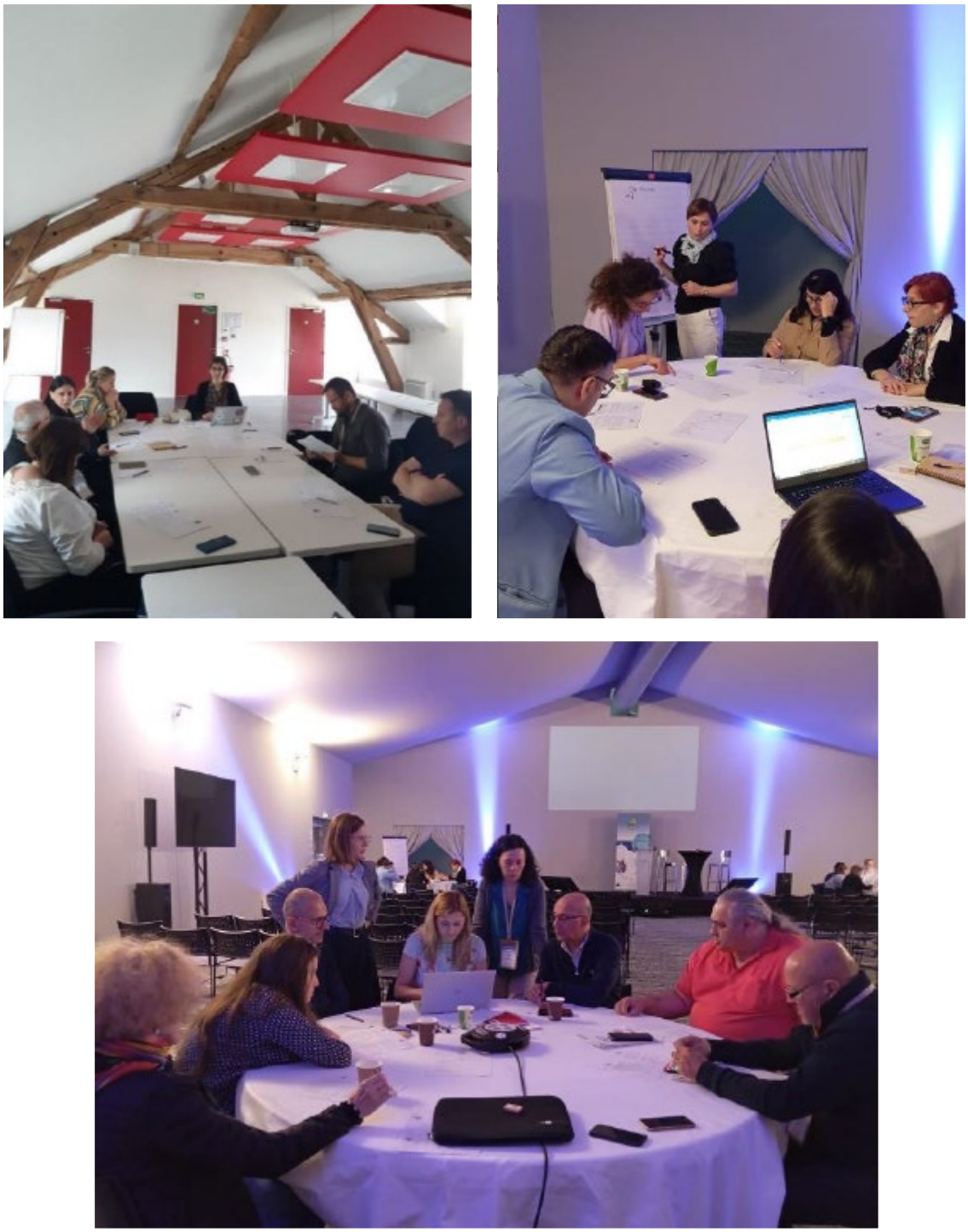


Figure 14. Working groups during the MLS exercise "Multisectoral knowledge to policy translation" in Paris (2024)

Multisectoral networking

In brief

Three networking events were organised to promote intersectoral interaction and enhance OH awareness.

Lessons learned

The networking events served as a platform to share experience and best practises in OH implementation. They provided valuable opportunities for intersectoral networking and served as springboard for collaboration and to initiate actions/initiatives in members' countries.

Networking activity either at the expert or institutional level is one of the main axes of action of the MLS Project. This was achieved through the organisation of networking meetings both at the global or regional scale.

The objectives of these events were to share experiences on OH implementation in the different network's countries and to foster intersectoral collaborations. They served as an opportunity to bring together network's members as well as national and/or regional stakeholders and engage them in multisectoral exercises.

Moreover, the focus of these events was the promotion of the OH approach to ensure the ownership of the concept by the members and the advocacy to stakeholders to foster further dissemination at the national level.

The meetings represented also a privilege moment for members from the same country to put into perspectives their national surveillance challenges and discuss about actions to cope with them. They catalysed the setting up of national initiatives upon return to their country.

Two regional and one global meeting (Figure 15) were organized, gathering respectively up to 40 and 170 participants from the 5 sectors of the network.

Figure 15. The MLS Global Meeting in Paris (June 2024)

LESSONS LEARNT FOR STRENGTHENING OH NATIONAL SYSTEMS

Multisectoral training allowed to bring together professionals from different sectors, exchange perspectives and needs and harmonize capacities. However, the competences of the OH workforce would need to be strengthened with the development of national and regional curricula.

Being part of the MLS Network increased OH awareness of the members and ensured their active participation in meetings and activities.

The country Focal Points also adopted active roles such as supporting stakeholder mapping and engagement of national stakeholders during OH national assessments in Armenia, Montenegro and Bosnia and Herzegovina.

MLS Focal Points, who had already taken part in previous MRA exercise on RVF in Tunis, showed abilities in supporting the implementation of the MRA exercise in Senegal.

During the OHMeSA studies the prioritization of threats with a OH approach allowed to identify case studies to assess strengths and needs of the OH national system and it was an opportunity for the different sectors to share information and concerns. They were also useful to discuss multisectoral risk factors (climate change, socio-economic impact) for specific pathogens, as it also happened during MRA exercises.

The activities and studies highlighted that environmental and socio-economic sectors – as well as non-institutional stakeholders such as communities and the private sector – are poorly considered in governance and strategies, despite their pivotal role in prevention and preparedness, and would need to be fully integrated by promoting a multisectoral and multilevel governance.

The COVID-19 pandemic offered a unique opportunity to illustrate the vital role that veterinary professionals play in addressing global health challenges and the importance of fostering better cross-sector collaboration, including diagnostic capacities and data sharing. Therefore, it would be pivotal to leverage experiences that support sharing of resources to prepare for future health emergencies.

The main lessons learned from MLS activities are described below.

Multisectoral training and exercises

Training organized with the aim of increasing awareness on OH approach should promote the participation of all the relevant sectors and should consider adaptation of curricula and tools to the multi-disciplinary target (e.g., metagenomics training program).

Training should be able to address the multiple aspects related to prevention and preparedness of arboviral infections as, for instance, the urban environment (e.g., training on urban vector mapping).

Relying on the “Training of Trainers approach” for the implementation of exercises ensured that country partners who had participated in previous exercises were involved in the development and facilitation of new ones enhancing cohesion, sense of ownership and representativeness.

Pre- and post- tests showed improved knowledge especially for those who have participated in more than one exercise (e.g., Multisectoral risk assessment exercise in Senegal).

Multisectoral exercises can contribute to monitor the progress of the countries towards integration of surveillance systems at national level (e.g., Integrated surveillance exercise for Crimean-Congo Haemorrhagic Fever Virus in the Balkans and Black Sea Region).

The participation in training courses organized by MLS motivated the beneficiaries to organise similar trainings in their countries (e.g., the OH course in Lebanon organised by the Institutions involved in MLS).

National assessments and surveys

National assessments and surveys can raise awareness and motivate national institutions to plan and implement actions able to strengthen the OH system (e.g., OH Centre in Serbia and Georgia; Road maps in Armenia and Montenegro in the context of the OHMeSA and involvement of veterinary laboratories in the COVID-19 crisis).

The absence of integrated digitalized national systems for data collection and analysis is critically hampering the implementation of activities aimed at the prevention and preparedness of health threats.

Environmental and socio-economic sectors, as well as non-institutional stakeholders such as communities and the private sector, are poorly considered in governance and strategies, despite their pivotal role in prevention and preparedness.

Involving international organization in the implementation of assessments and surveys has reduced overlapping and has favoured alignment, has promoted exchange of approaches between the organizations and MLS, and has contributed to sustainability.

Decision-makers of the MLS Network should consider creating a multisectoral and multilevel governance when designing and implementing multisectoral community-based interventions for VBDs prevention and preparedness. They should identify connection agents recognized by communities and institutional actors, to act as a link and continuously engage them.

With the aim of implementing studies and assessments, new methodologies have been piloted: e.g. the One Health Conceptual Framework and the Prioritization of OH pathogens for case studies (15, 16).

Knowledge to policy development

Ensuring that the research findings are accessible to decision-makers is a prerequisite for integrating this knowledge into national and international health plans. However, the technical staff need to enhance this capacity especially when a OH approach is needed (e.g., Policy brief training and Multisectoral knowledge to policy translation exercise).

Multisectoral networking

The networking events represented a platform to share experience and best practises in OH implementation. They provided valuable opportunities for intersectoral networking, setting up of collaboration and actions/initiatives in members' countries.

CONCLUSIONS AND THE WAY FORWARD

MLS implemented a specific capacity building strategy aimed at reinforcing national One Health systems through trainings, studies and networking and by increasing the competencies of the technical staff needed to make acquired evidence useful for policy development.

This strategy was able to enhance specific skills (e.g., enhanced laboratory and risk assessment capacities), but also to increase awareness in relation to the benefit of a OH approach (countries involved in MLS were able to start robust integrated surveillance on arbovirus infections, to establish OH national Centres, to implement OH courses).

On the basis of the lessons learned, the following aspects can be further considered for future actions aimed at reinforcing national OH systems:

- reinforce collaboration and synergies among all the actors involved for OH integration in prevention, preparedness and response, including the international organisations of the Quadripartite, that are providing several opportunities for exercises and assessments at national level;
- assist in identifying the mechanism for strengthening intersectoral collaboration for the development of the One Health operational action plan;
- improve communication and coordination between the human health, animal health, environment and other relevant sectors in order to plan joint and synergistic actions;
- promote the enhancement of laboratory capacities towards the concept of "OH laboratory system", including the genomic surveillance capacity of using common genomic databases (online repositories of genomic variants), and intersectoral trainings on genomic data analysis;
- promote the adoption of integrated risk assessment exercises in training programme at national level to ultimately facilitate integrated risk assessment in the national plans;
- reinforce integrated prevention and preparedness by assessing the plans via checklists, by testing the plans via simulation exercises to identify areas for needed improvement, and by training relevant sectors and actors;
- promote the monitoring of the process towards the adoption of OH in surveillance system for example with periodic multisectoral exercise on integrated surveillance as done in the context of MLS;
- establish or consolidate integrated digitalized national systems for data collection and analysis;
- include in studies and exercises the environmental and social sciences sectors and all the relevant stakeholders, including public and private actors and communities, to ultimately involve them in national plans;
- promote awareness of the OH approach by leveraging MLS champions and by supporting effective multisectoral science to policy translation to acknowledge OH benefits.
- develop multisectoral training curricula to capacitate the OH workforce by strengthening integrated knowledge for surveillance, prevention and preparedness to threats to health.

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APPENDIX A
List of country institutions involved in MediLabSecure network

Country	Institution
Albania	Food Safety and Veterinary Institute
	Institute of Public Health
Algeria	Institut National de la Médecine Vétérinaire
	Institut National de Santé Publique
	Institut Pasteur d'Algérie
Armenia	National Center for Disease Control and Prevention, Ministry of Health of the Republic of Armenia
	Republican Veterinary-sanitary and phyto-sanitary center for laboratory services (SNCO)
	Veterinary Inspectorate of the State Service for Food Society, Ministry of Agriculture of the Republic of Armenia
Bosnia and Herzegovina	Ministry of Civil Affairs of Bosnia and Herzegovina
	Public Health Institute of the Federation of Bosnia and Herzegovina
	University Clinical Center of Sarajevo
	Veterinary Faculty Sarajevo
	Veterinary Services, Ministry of Foreign Trade and Economic Relations of Bosnia and Herzegovina
	Institute for Microbiology and Molecular Diagnostics
	Public Health Institute of Republic of Srpska
	Veterinary Institute of the Republic of Srpska "Dr. Vaso Butozan"
	Department of Health and Other Services of Brčko District of Bosnia and Herzegovina
Burkina Faso	Centre Muraz Bobo-Dioulasso, Département Sciences Biomédicales
	Laboratory of Virology
	Direction Générale des Services Vétérinaires, National Livestock Laboratory
	Ministère des Ressources Animales et Halieutiques, Services Vétérinaires
	National Public Health Institute of Burkina Faso
Egypt	Ain Shams University
	Animal Health Research Institute
	Ministry of Health and Population
	National Research Centre
Georgia	Laboratory of Ministry of Agriculture
	National Center for Disease Control and Public Health
	National Food Agency, Veterinary Department
Jordan	Laboratory Directorate of the MoH
	Ministry of Agriculture
	Ministry of Health
Kosovo*	National Institute of Public Health of Kosovo
	University of Prishtina, Faculty of Agriculture and Veterinary Sc.
	Kosovo Food & Veterinary Agency
Lebanon	Lebanese Agricultural Research Institute- LARI
	Lebanese University, Faculty of Public Health
	Ministry of Public Health
	Ministry of Agriculture
	Rafik Hariri University Hospital
Libya	National Center of Disease Control
	Ministry of Agriculture

Country	Institution
Mali	Institut National de Recherche en Santé Publique
	Institut National de Santé Publique
	Laboratoire Central Vétérinaire
	Malaria Research and Training Center-USTTB
	Ministère de l'Elevage et de la Pêche
Mauritania	Institut National de Recherche en Santé Publique (INRSP)
	Ministère de l'Élevage
	Office National de Recherches et de Développement de l'Elevage
	Université de Nouakchott Al-Aasriya
Montenegro	Biotechnical faculty
	Diagnostic Veterinary Laboratory
	Institute of Public Health
	Ministry of Agriculture and Rural Development
Morocco	Institut National d'Hygiène
	Institut Pasteur du Maroc
	Ministry of Health
	Office national de sécurité sanitaire des produits alimentaires (ONSSA)
	Ministry of Agriculture, Fisheries, Rural Development, Water and Forests
Niger	Centre de Recherche Médicale et Sanitaire (CERMES)
	Laboratoire Central de l'Elevage (LABOCEL)
	Ministère de l'Agriculture et de l'Elevage
	Ministry for Public Health
Palestine**	Ministry of Health
	Ministry of Agriculture
	Veterinary microbiology Laboratory
Senegal	Institut Pasteur in Dakar
	Institut Sénégalais de Recherches Agricoles
	Ministère de l'Elevage et des Productions Animales
	Ministry of Health
Republic of Macedonia	Institute of Public Health
	Ministry of Agriculture, Forestry and Water Economy
	Ss. Cyril and Methodius University in Skopje, Faculty of Veterinary Medicine
Serbia	Faculty of Agriculture, University of Novi Sad
	Institute of Public Health of Serbia "Dr. Milan Jovanovic Batut"
	Institute of Veterinary Medicine of Serbia
	Institute of Virology, Vaccines and Sera, Torlak
	Ministry of Agriculture, Forestry and Water Management
Tunisia	Ministry of Agriculture
	Institut Pasteur de Tunis
	Ministère de la Santé Publique
Türkiye	Ankara University, Faculty of Veterinary Medicine
	Hacettepe University
	Public Health Institute of Türkiye

* This designation is without prejudice to positions on status and is in line with UNSCR 1244 and ICI Advisory opinion on the Kosovo declaration of independence

** This designation shall not be construed as recognition of a State of Palestine and is without prejudice to the individual positions of EU Member States on the issue

APPENDIX B
MLS strategic document: executive summary

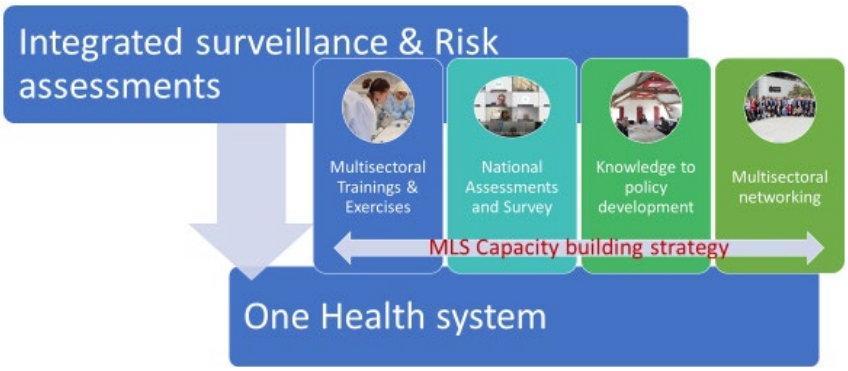
Aim

To highlight relevant lessons learnt emerged during the implementation of the MLS activities (including laboratory training, exercises, assessments, operational studies, etc.), to share actionable recommendations with the project's stakeholders.

Target

Supranational and national institutions in charge for strengthening OH operationalization and to MLS members who are in the journey to strengthen their OH national systems.

Strategy and activities



MLS adopted a comprehensive strategy including capacity building activities aimed at strengthening each of the sectors involved and intersectoral activities aimed at promoting and strengthening integration between sectors.

The focus of the strategy during the first phase of the project was on improving OH surveillance and risk assessment of arbovirus infections by enhancing laboratory capacities and promoting multisectoral activities. This strategic approach provided valuable progresses at country level and therefore with the starting of the new phase in 2019, this capacity building strategy was again adopted but with an extended focus, to facilitate not only the reinforcement of the surveillance and risk assessment, but to promote the entire OH system development at national level.

Main lessons learned from MLS activities

Activities	Lessons learned
Multisectoral training and exercises	Training should promote the participation of all the relevant sectors and consider adaptation of curricula and tools to the multi-disciplinary target
	Training should address the multiple aspects related to prevention and preparedness of arboviral infections as, for instance, the urban environment
	Relying on the "Training of Trainers approach" for the implementation of exercises ensured that country partners who had participated in previous exercises were involved in the development and facilitation of new ones enhancing cohesion, sense of ownership and representativeness.
	Pre- and post- tests showed improved knowledge especially for those who have participated in more than one exercise
	Multisectoral exercises can contribute to monitor the progress of the countries towards integration of surveillance systems at national level The participation in training organized by MLS motivated the beneficiaries to organise similar trainings in their countries

Activities	Lessons learned
National assessments and surveys	National assessments and surveys can raise awareness and motivate national institutions to plan and implement actions able to strengthen the OH system The absence of integrated digitalized national systems for data collection and analysis is critically hampering the implementation of activities aimed at the prevention and preparedness of health threats. Environmental and socio-economic sectors, as well as non-institutional stakeholders such as communities and the private sector, shoul be considered in governance and strategies, considering their role in prevention and preparedness. Involving international organization in the implementation of assessments and surveys has reduced overlapping and has favored alignment exchange of approaches between the organizations and MLS, and has contributed to sustainability. Decision-makers should consider creating a multisectoral and multilevel governance when designing and implementing multisectoral community-based interventions for VBDs prevention and preparedness. They should identify connection agents recognized by communities and institutional actors, to act as a link and continuously engage them.
Knowledge to policy development	Ensuring that the research findings are accessible to decision-makers is a prerequisite for integrating this knowledge into national and international health plans. However, the technical staff need to enhance this capacity especially when a OH approach is needed .
Multisectoral networking	The networking events represented a platform to share experience and best practises in OH implementation. They provided valuable opportunities for intersectoral networking, setting up of collaboration and actions/initiatives in members' countries.

The way forward

On the basis of the lessons learned, the following aspects should be further considered for future actions aimed at reinforcing national OH systems:

- ***reinforce collaboration and synergies*** among all the actors involved for OH integration in prevention, preparedness and response, including the international organisations of the Quadripartite, public and private actors and communities;
- promote the concept of "***OH laboratory system***", including the genomic surveillance capacity of using common genomic databases (online repositories of genomic variants), and intersectoral trainings on genomic data analysis;
- ***reinforce integrated prevention and preparedness by assessing the plans*** via checklists, by testing the plans via simulation exercises to identify areas for needed improvement, and by training relevant sectors and actors;
- establish or consolidate ***integrated digitalized national systems*** for data collection and analysis;
- ***capacitate the OH workforce*** by developing multisectoral training curricula to strengthen integrated knowledge for surveillance, prevention and preparedness to threats to health.

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