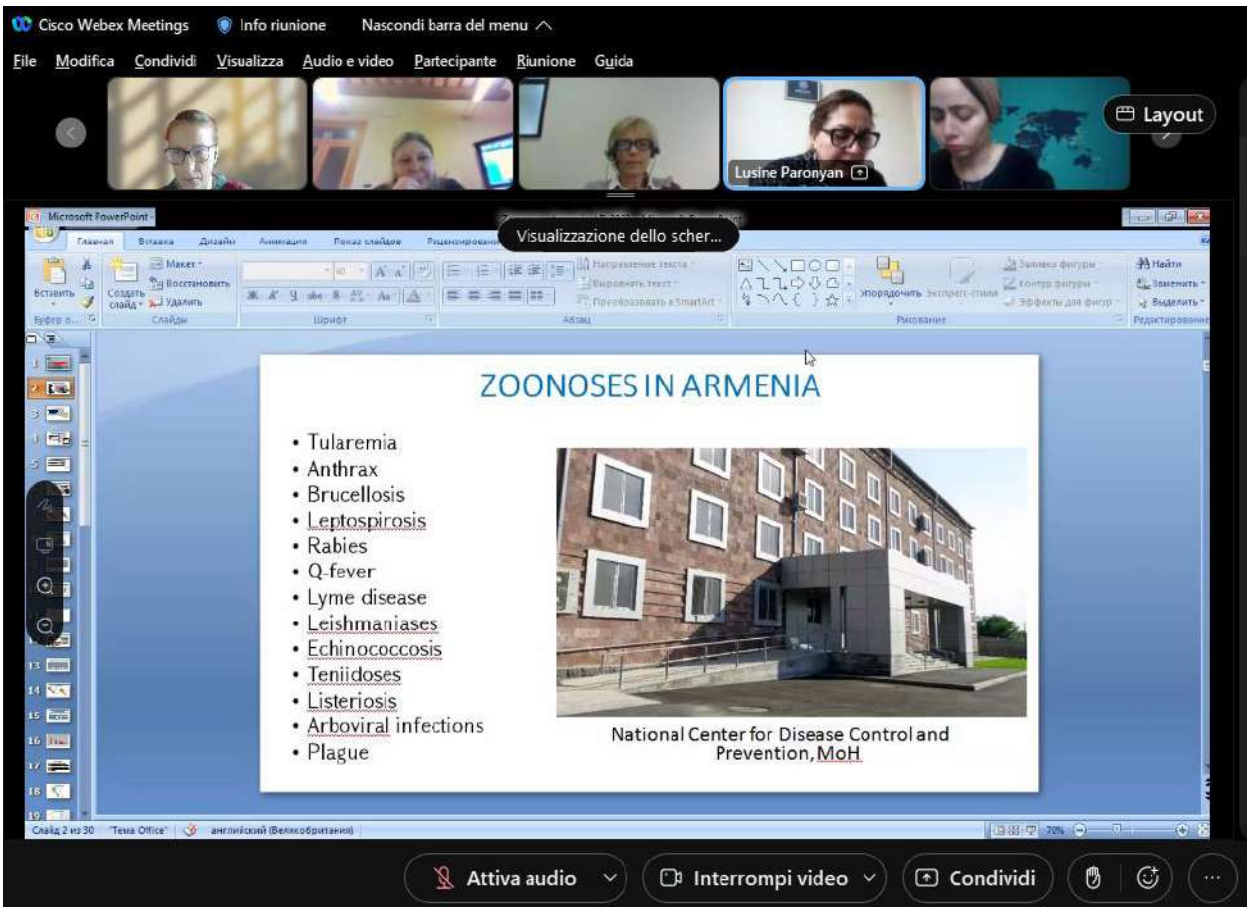
One Health MESAPLUS Study in Armenia

Report

AVDANCED DRAFT 10/08/2022



Acknowledgements

This study was possible thanks to the collaboration and availability of the relevant staff of the Institutions involved in the Surveillance of CCHF and Anthrax in Armenia who generously shared their experiences and discussed the lessons learned.

A special thanks to Dr Lusine Paronyan and Dr Georgi Avetisyan who coordinated and supported the preparation of the study documents and the organisation of the Workshops with professionalism and enthusiasm.

Alessia Milano, Claudia Robbiati and Maria Grazia Dente at ISS organised, implemented the Study and drafted this report with the support of Silvia Declich and in coordination with Laura Amato, Ombretta Pediconi and Paolo Calistri at IZS-Teramo.

Laura Amato, Ombretta Pediconi and Paolo Calistri provided their expertise and technical support in the implementation of the Workshops.

This report was finalized and consolidated with the support of Lusine Paronyan (National Center for Disease Control and Prevention: Zoonotic and Parasitic Diseases Epidemiology Department); Georgi Avetisyan (Food Safety Inspection Body) and in coordination with Tigran Yesayan (Food Safety Inspection Body), Shushan Sargsyan and Edgar Petrosyan ("Reference Laboratory Center" Branch of National Center for Disease Control and Prevention: MoH Reference Virology lab), Arman Gevorgyan (Republican Veterinary and Phyto-Sanitary Center for Laboratory Services), Arsen Manucharyan ("Reference Laboratory Center Branch" of National Center for Disease Control and Prevention: Laboratory of Episootology, Ectoparasitology and Entomology), Lilit Avetisyan (National Center for Disease Control and Prevention), Tigran Markosyan (Risk Assessment Research Center, MoE), Ruben Danielyan ("Shirak" branch of National Center for Disease Control and Prevention), Melanya Karapetyan, Marianna Khachatryan and Ashot Danielyan (Food Safety Division, Ministry of Economy), Perch Tumanyan (Reference Laboratory of Especially Dangerous Pathogens, Republican Veterinary and Phytosanitary Laboratory Services Center, FSIB), Tatevik Zuerker (Ministry of Environment), David Pipoyan (Center for Ecological-Noosphere Studies-National Academy of Sciences), Lilit Khachatryan and Dzovinar Melkom Melkomian (BTRP CH2M/Jacobs Armenia Branch Office), Ekaterine Jabidze (Incident Management Support Officer, WHO Armenia Country Office).

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1. INTRODUCTION

1.1 The One Health MediLabSecure Early Warning Situation Analysis Study (OHMESA+ Study) in Armenia

The MediLabSecure project aims to prevent vector-borne diseases by reinforcing an international network of laboratories and public health institutions in 22 beneficiary countries across the Mediterranean, Black Sea and Sahel Regions. The partner institutions Institut Pasteur, Instituto Nacional de Investigacion y Tecnologia Agraria y Alimentaria (INIA), Istituto Superiore di Sanità (ISS), Avia-GIS, Institut de Recherche pour le Developpement (IRD), in collaboration with Istituto Zooprofilattico Sperimentale dell'Abruzzo e del Molise "G. Caporale" (IZS-Teramo) are working in synergy by sharing their expertise across five working groups (WPs) namely human virology, animal virology, medical entomology, public health and veterinary services, early warning tools/modelling. The project promotes integrated surveillance of emerging arboviruses in beneficiary countries through a One Health (OH) approach. OH is an approach to designing and implementing programmes, policies, legislation and research, in which multiple sectors communicate and work together to achieve better public health outcomes.

The OHMESA+ Study is a situation analysis of vector borne disease surveillance in three of the MediLabSecure countries, applying the OH approach by involving the human, animal, entomology and environment sectors. One of the involved countries is Armenia.

The goal of the OHMESA+ study is to contribute to the integration of human, animal and entomological surveillance of arboviruses and the inclusion of relevant environmental data to enhance early warning capacity in Armenia.

Specific objectives of the study are (Annex 1 and 2):

1. Describe how the collection, analysis and dissemination/exchange of information is organized within and between human, animal and entomological surveillance of arboviruses, (including relevant environmental data) in Armenia;

2. Describe how, when and where essential information for prediction, early warning and risk assessment of arbovirus infections are collected, stored and shared by the relevant sectors;

3. Discuss main challenges and success stories in establishing a functional inter-sectoral utilisation of the information collected across sectors in these three countries for prediction, detection, early warning and risk assessment purposes;

4. Facilitate the utilisation of the available information for the development of the integrated early warning/risk assessment (also with GIS training support);

5. Assess the adequacy of the "One Health based Conceptual Framework (OHCF)"[a] to strengthen the integration of OH approaches in prevention, preparedness and response to health threats.

The study has been developed and guided by a team of investigators comprising MediLabSecure WP4 leaders (Public Health and Veterinary Services, ISS and IZS-Teramo) and focal points of the involved sectors in Armenia.

The OH MeSAPLUS study in Armenia started in June 2021 with the drafting of preliminary documentation and ToRs. During the kick-off meeting on 2nd November 2021, the study's methodology was discussed and six phases were identified accordingly (Figure 1).

a The One Health Conceptual Framework (OHCF) aims at guiding the development and adoption of comprehensive OH prevention, preparedness and response strategies.

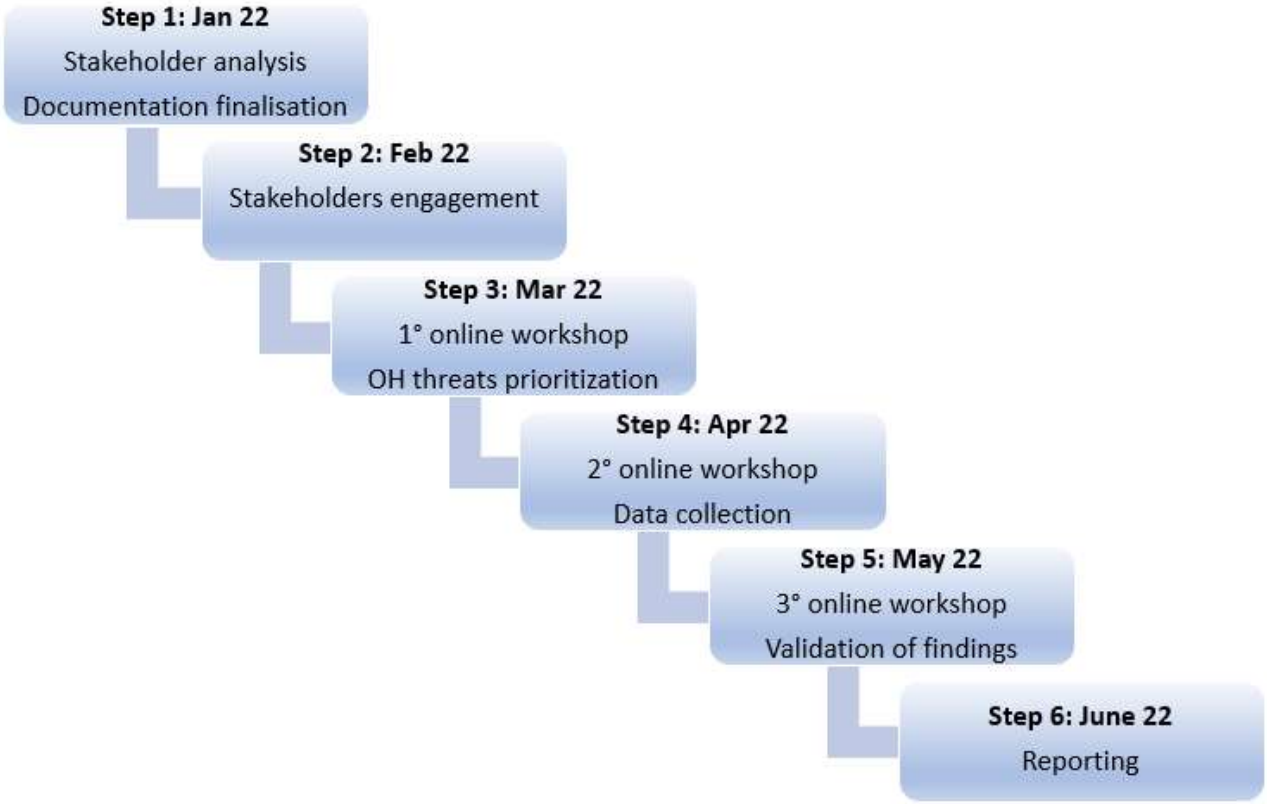


Fig 1: The six-step OHMESAPLUS Study.

1. **Kick-off:** Engage key stakeholders and finalise the study portfolio and tools.
2. **Stakeholder mapping:** Outline relevant stakeholders to be engaged in the study.
3. **First Workshop:** Prioritisation of OH threats at country level.
4. **Second workshop:** Data and information collection, and training needs assessment
5. **Third workshop:** Validation of preliminary results
6. **Reporting and Dissemination:** Development of the study report in collaboration with key stakeholders.

1.2 Arboviral diseases in Armenia and vectors' presence[b]

Armenia is a landlocked country in the southern Caucasus region, which shares borders with Azerbaijan, Georgia, Iran and Turkey. The geography is primarily mountainous with little forestland (Figure 2). The economy relies on manufacturing, services, remittances, and agriculture. Armenia has a population of about 3 million, more than one third of whom live in the capital, Yerevan. The main burden of disease is non-communicable diseases, particularly cardiovascular diseases [1]. The health care system is divided into three administrative layers: national, regional and municipal or community. Operation and ownership of health services have been devolved to regional and local government.

Fig 2: Map of Armenia.

[b] From Report of the NATIONAL VECTOR CONTROL NEEDS ASSESSMENT (VCNA) IN ARMENIA, Prepared by National Center for Disease Control and Prevention Working Group 2021 (4)

In Armenia a large entomological survey (64,567 mosquitoes and 45,180 *Ixodes* ticks) in 2006 identified 125 distinct strains of 10 arboviruses, including West Nile fever virus, tick-borne encephalitis virus, Tamdy, Tahyna, Geta, Batai, Sindbis, Crimean-Congo hemorrhagic fever, Bhanja, Dhori. Historically, the only case of Crimean-Congo hemorrhagic fever (CCHF) in human was registered in 1974 in Sunik region of Armenia, which ended with a death of a young zoologist. During 1986-1996 entomological survey, the CCHF virus was found in ticks in the Syunik, Vayots Dzor and Kotayk regions in Armenia. In 2016 CCHF virus antigen was detected from 6 tick species. Tick-borne encephalitis (TBE) virus was historically diagnosed in Armenia but has not been studied in recent years. Investigations carried out in 1985-1992, showed TBE virus circulation among bloodsucking arthropods' species found in almost all landscape zones of the country. Natural foci of TBE were identified in various climatic and geographical zones.

Ticks that can be vectors of infectious diseases are widely distributed in Armenia (Figure 3).

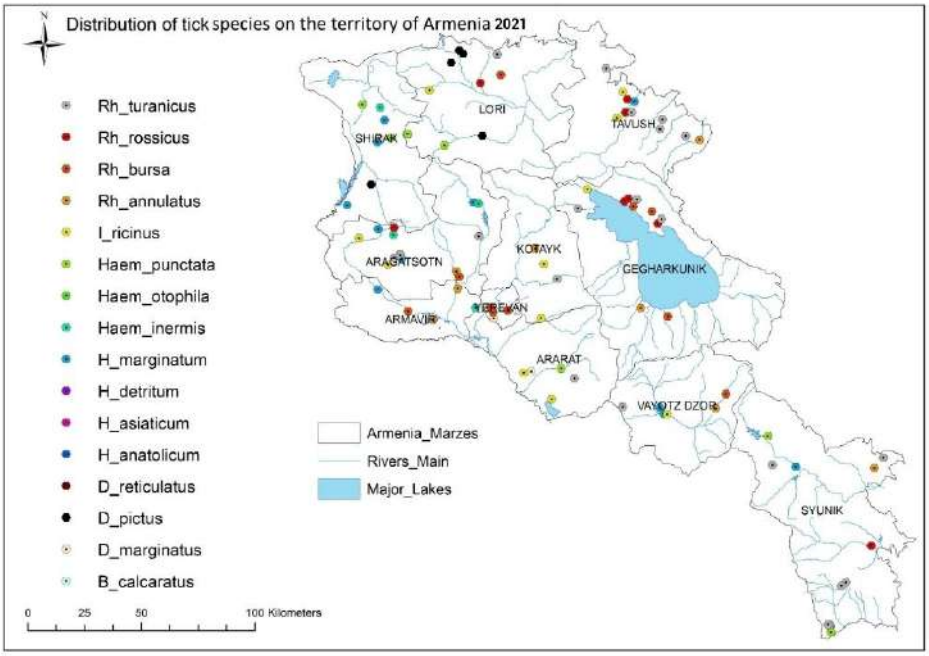


Fig 3: Ticks' species distribution in Armenia (4)

The family Ixodidae, includes about 15 genera, which are distributed on all continents. Only 5 of Ixodidae generas are found in Armenia: D. pictus, D. marginatus, D. reticulatus species were found from Dermacentor genus; H. marginatum, H. asiaticum, H. anatolicum, H. detritum were found from Hyalomma genus; R. bursa, R. sanguineus, R. turanicus, R. rossicus, R. annulatus(B.calcaratus) were found from the genus Rhipicephalus; H. sulcata, H. numidiana, H. concinna, H. otophila, H.punctata, H. warburtoni, H. inermis species were found from the genus Haemaphisalis; I. ricinus, I. laguri arm., I. redikorzevi, I. crenulatus were found from the Ixodes genus. Ixodes ticks monitoring and sampling in the territory of the Republic of Armenia is still going on, and there is a tendency to continue.

West Nile fever is now spread all over the world, including the Mediterranean, causing high mortality. It is transmitted by the bites of Culex, the species widely spread in Armenia.

Aedes albopictus and Aedes aegypti mosquitoes have been found in the territories bordering Armenia. A VectorNet (European network for medical and veterinary entomology) field mission in Armenia in 2016 identified 29 different species of mosquitoes, including 6 anophelines, 10 aedes, 3 culiseta, 8 culex, 1 uranotaenia and 1 coquilletidia, including *Aedes albopictus* for the first time in the northern part of Armenia (bordering to Georgia) (Figure 4).

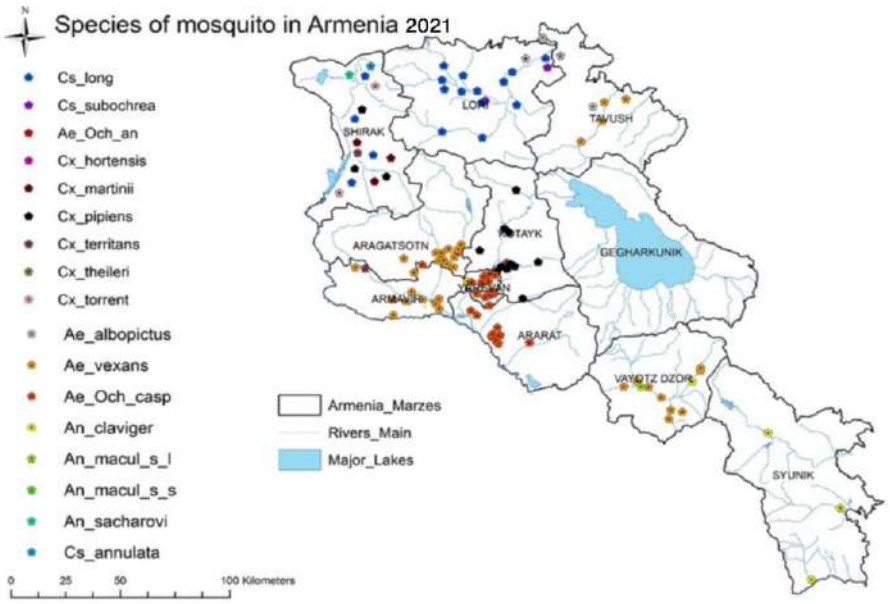


Fig 4: Mosquito species in Armenia, 2021 (4)

Aedes albopictus (Stegomyia albopicta), also known as Asian tiger mosquito, was recorded in a single locality, at the border point with Georgia, on the main road Tbilisi-Yerevan. Routine entomological surveillance (conducted by field entomologists working at NCDC branches) in 2017-2020 on presence/absence of Aedes invasive species revealed expansion of the area of Aedes albopictus. This important potential vector of many arboviruses (yellow fever, dengue, Chikungunya, Zika), was recorded during the four consecutive years 2016-2020. Only adults of Aedes albopictus were recorded in 2017 in the same locality as in 2016, border point Bagratashen, 450m above sea level. In 2018 entomological investigation recorded its establishment (adults and larvae) and spread in northern Armenia up to 15 km in Ayrum town (500 MAMSL). In 2019-2021 adults and larvae of Aedes albopictus were recorded 60km inland from border point in Ijevan town, again on the main road Tbilisi-Yerevan (750 MAMSL) (Figure 5).

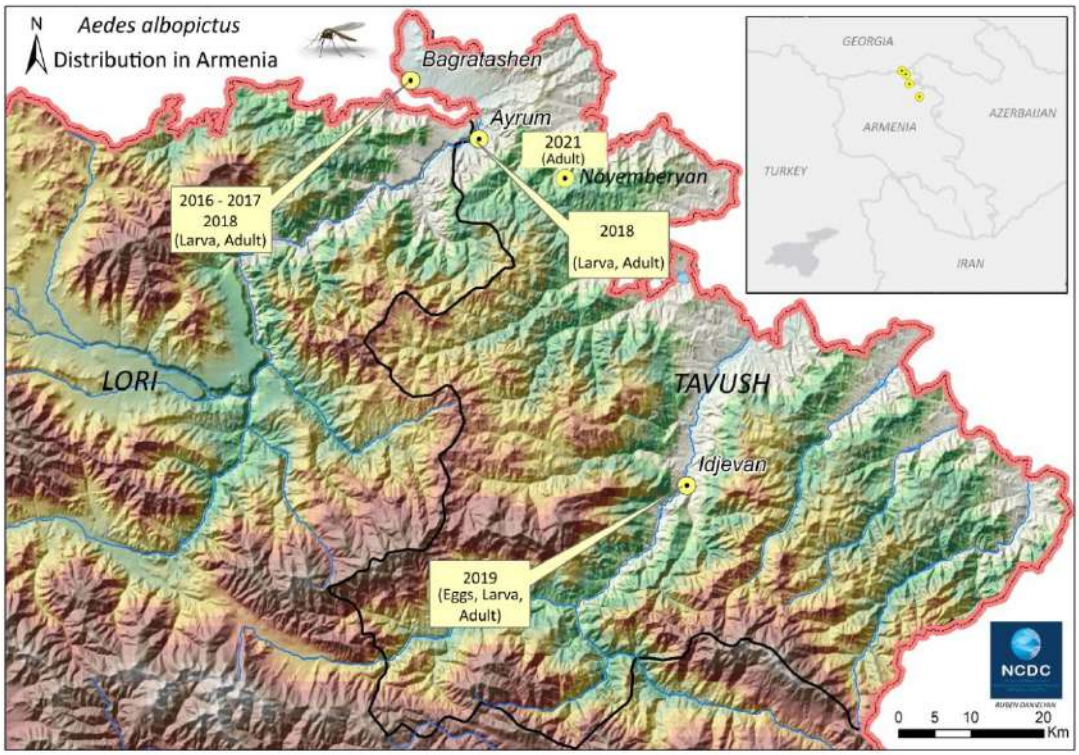


Fig 5: Expansion of the area of Aedes Albopictus in Armenia, 2016-2021 (4)

Available literature indicates Sandfly (Pappataci) fever was reported in Armenia until the late 1970s. Phlebotimine shadflies are found in different altitudes of the country. Pappataci fever was found mostly in visitors (24 times more than in residents) in Ararat valley and Southern part of Armenia. Currently, no

cases of Sandfly fever are registered in Armenia due to lack of diagnostic capacities and awareness of medical personnel.

1.3 One health approach implementation in Armenia[c]

Armenia has implemented a number of activities to introduce the One Health approach. While the main partners for an integrated approach in the control of zoonotic diseases are MoH and MoE[d], other relevant stakeholders (such as Ministry of Nature Protection for Wildlife Animals) are also involved in activities. Within the structure of the MoH an intersectoral expert taskforce for zoonotic diseases has been established. Surveillance systems for zoonotic diseases in both human and animal health sectors are in place. The list of 170 communicable diseases that are subject to reporting in Armenia includes zoonotic diseases with respective human and animal case definitions. The electronic integrated disease surveillance system (EIDSS) is likely to enhance timely exchange of information between sectors that are currently based on official correspondence. The EIDSS has already been developed but is not yet fully operational. Entomological surveillance, monitoring of rodent populations, and surveillance of the bird population are some of the other activities that are routinely performed and analyzed using GIS mapping to assess potential risk of zoonotic events. Livestock population estimates are developed by the National Statistical Service (NSS) each year, the program of *registration* and numbering of bovine *animals*is started. Laboratory capacities to support a strong surveillance system for zoonotic diseases could be strengthened and expanded, especially in the animal sector. In 2014, a joint decree of the MoH and MoE defined a list of eight priority zoonotic diseases of greatest public health concern: anthrax, avian influenza, brucellosis, glanders, leptospirosis, rabies and tuberculosis. Based on a strong legal framework, guidelines and SOPs have been developed to jointly detect, prevent and respond to these priority diseases. State guaranteed indemnities are in place to compensate for loss of animals due to epidemics. Several exercises have been conducted to practice and test the skills of both human and animal health workers to investigate and respond to zoonotic events as rapid response teams, in a coordinated and

[c] WHO. Joint External Evaluation of IHR Core Capacities of the Republic of Armenia [Internet]. 2016. Available from: https://www.who.int/publications/i/item/WHO-WHE-CPI-2017.14

[d] In the Republic of Armenia, these functions are performed by the Ministry of Economy. Ministries of Agriculture and Economy merged in 2018.

collaborative manner (e.g. avian influenza, anthrax and brucellosis). A number of activities were implemented to introduce the One Health approach within the framework of the United States Cooperative Biological Engagement Program (CBEP). For that purpose regional training and exercises on brucellosis were conducted in 2015 with participation of all relevant stakeholders and international experts from the United States and neighbouring Georgia. Armenia has already demonstrated its capacity to control outbreaks of zoonotic diseases on several occasions. Timely detection followed by rapid joint responses have helped the country to control outbreaks of brucellosis and anthrax in the past. Veterinarians participated in the South Caucasus FELTP in 2010-2017, now they regularly participate in FETP frontline Armenia and EE/SC FETP intermediate programs. "A plan for continuous education of public health aspects in animal health has been developed and implemented involving all levels. Currently around 650 veterinarians are operating in the communities on a contractual basis. The FSIB of the MoE organizes short-term training and updating of information for veterinary specialists engaged in response to zoonotic events.

The “National Bridging Workshop on the International Health Regulations (IHR) and the OIE Performance of Veterinary Services (PVS) Pathway” (6) in 2019 assessed the level of integration for 15 technical areas for five priority zoonoses (Figure 6).

Technical area (cards)	Rabies	Anthrax	Avian flu	Brucellosis	Echinococcosis	Score
Finance						8
Joint surveillance						8
Coordination at technical Level						6
Field investigation						6
Risk assessment						6
Communication w/ media						5
Communication w/ stakeholders						5
Laboratory						5
Response						5
Coordination at the local Level						4
Education and training						4
Emergency funding						4
Legislation / Regulation						2
Human resources						2
Coordination at high Level						1

For each disease, the performance of the collaboration between the human health and the animal health sectors is color-coded: green for “good collaboration”, yellow for “some collaboration”, and red for “collaboration needing improvement”. The score uses a semi-quantitative scale (2 points for a red card, 1 for a yellow card and 0 for a green card). Technical areas marked in bold were selected and addressed in-depth throughout the rest of the workshop.

Fig 6: Assessment of the integration for 15 technical areas for five priority zoonoses (5).

2. PORTFOLIO DEVELOPMENT and STAKEHOLDER MAPPING

The development of the portfolio (Annex 3) was included in the study methodology as first step aimed at collecting the available information regarding CCHF/V and surveillance measures currently in place in Armenia. The ISS team started to develop the document on the basis of the documentation available, then the draft document was shared with the Armenian referents for integrations and amendments. Finally, conflicting and lacking information were discussed during the second Workshop.

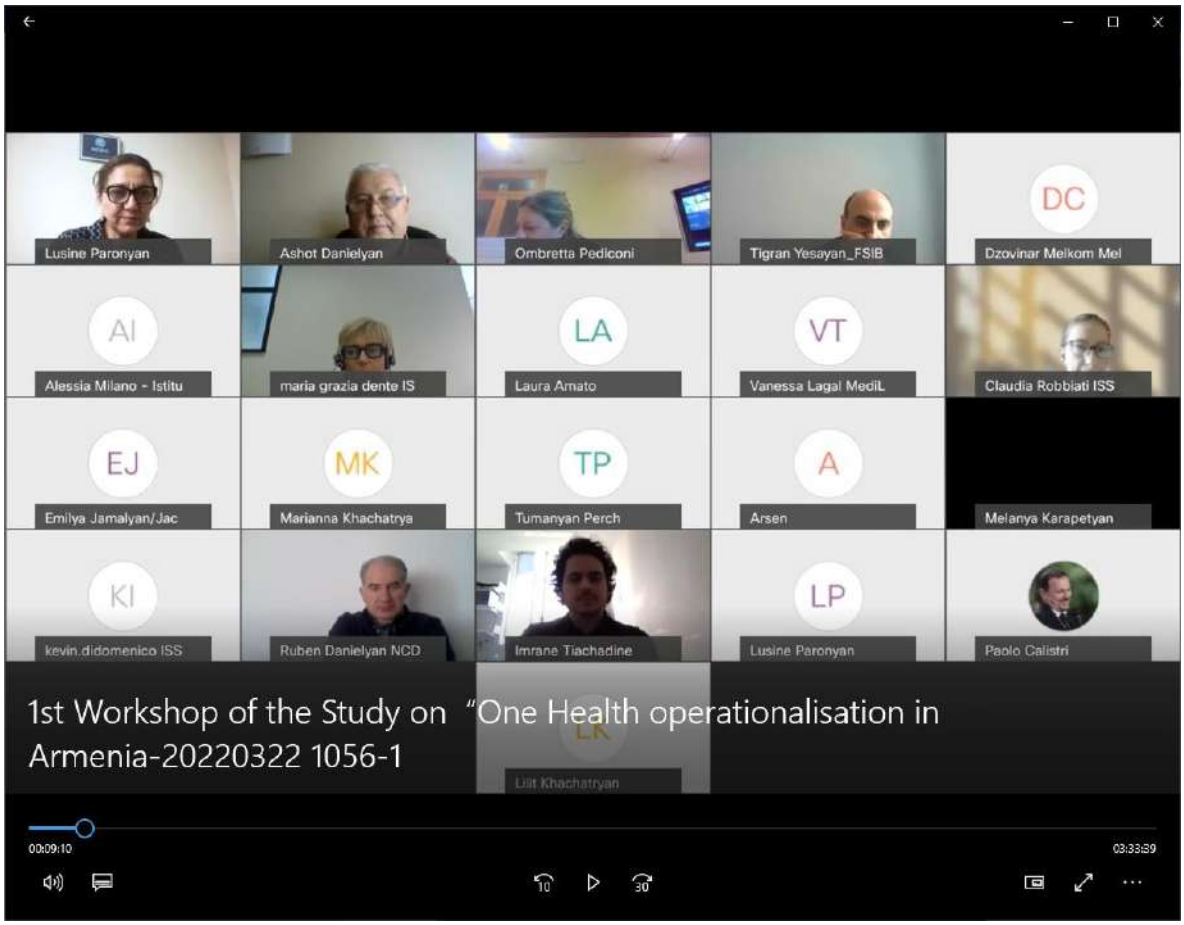
A stakeholder analysis was performed and the following stakeholders identified (Table 1):

Institution	Department	Referent
National Center for Disease Control and Prevention (NCDCP)/MoH	Deputy Director General	Lilit Avetisyan WHO IHR-2005 National Focal Point
National Center for Disease Control and Prevention (NCDCP)/MoH	Department of Epidemioloy of Zoonotic and Parasitic Diseases	Dr Lusine Paronyan
"Reference laboratory Center" branch of National Center for Disease Control and Prevention (NCDCP)/MoH	Virology Laboratory	Dr Shushan Sargsyan
"Reference laboratory Center" branch of National Center for Disease Control and Prevention (NCDCP)/MoH	Virology Laboratory	Dr Edgar Petrosyan
"Reference laboratory Center" branch of National Center for Disease Control and Prevention (NCDCP)/MoH	Laboratory of Episootology, Ectoparasitology and Entomology	Dr Arsen Manucharyan
"Reference laboratory Center" branch of National Center for Disease Control and Prevention (NCDC)/MoH	Laboratory of Especially dangerous Infections and Live Culture Museum	Dr Armine Khazazyan
National Center for Disease Control and Prevention (NCDC)/MoH	"Shirak" branch	Dr Ruben Danielyan

Institution	Department	Referent
Food Safety Inspection Body of the Government of the Republic of Armenia (FSIB), MoE	Head of FSIB	Dr Georgi Avetisyan WOAH delegate
Food Safety Inspection Body of the Government of the Republic of Armenia (FSIB), MoE	International Affairs Department	Dr Tigran Yesayan
Risk Assessment Research Center (RAC), MoE	Head of RAC	Dr Tigran Marcosyan
Reference Laboratory of Especially Dangerous Pathogens of Veterinary and Phyto-Sanitary Laboratory Center, FSIB	Head of Reference Laboratory of Especially Dangerous Pathogens	Dr Perch Tumanyan
Veterinary and Phyto-Sanitary Laboratory Center, FSIB	Head of Veterinary and Phyto-Sanitary Laboratory Center	Dr Arman Gevorgyan
Ministry of Economy	Food Safety Division	Melanya Karapetyan
Ministry of Economy	Food Safety Division	Marianna Khachatryan
Ministry of Economy	Food Safety Division	Ashot Danielyan
Ministry of Environment	Specially Protected Areas of Nature and Biodiversity Policy Department	Tatevik Zuerker
Center for Ecological-Noosphere Studies- National Academy of Sciences		David Pipoyan
BTR Program, CH2M/Jacobs Armenia Branch Office	Training specialist	Lilit Khachatryan
BTR Program, CH2M/Jacobs Armenia Branch Office	One Health specialist	Dzovinar Melkom Melkomian
WHO Armenia Country Office	Incident Management Support Officer	Ekaterine Jabidze

Table 1: Identified stakeholders.

3. FIRST WORKSHOP (22 March 2022)



3.1 Aim and objectives

The aim of the first workshop was to identify OH priority pathogens in Armenia, in order to:

> assess One Health approaches integrated in preparedness, surveillance and control strategies;

> assess key challenges that are hampering the integration of OH approaches;

> assess adequacy of the One Health Conceptual Framework to facilitate the operationalisation of One Health strategies in Armenia.

3.2 Methods

Relevant zoonotic diseases for Armenia were identified according to National Reports (JEE Armenia 2016, VCNA Armenia 2021, NBW Armenia final report, One Health Armenia OH 2021) and to MLS aims. Additional potential threats were identified through preliminary consultation with Armenian key stakeholders. The threats were prioritized with a consultation of relevant stakeholders during the 1st virtual workshop (Annex 4), which was developed through two polling sessions.

The workshop was organised with a participatory approach, involving relevant stakeholders, according to the following steps:

1. Seeking consensus about the identified Arboviruses pathogens for Armenia
2. Seeking consensus about the identified additional pathogens for Armenia
3. Seeking consensus about indicators for the prioritization of the selected pathogens;
4. Ranking the Arboviruses pathogens on the basis of agreed prioritization indicators and discussion;
5. Ranking additional potential pathogens on the basis of agreed prioritization indicators and discussion.

3.3 Results

- ✓ *Rapid Literature Review and Key Stakeholders' Preliminary Consultation*

The rapid literature review together with the preliminary consultation of key stakeholders allowed to identify the pathogens included (Table 2).

	MLS aim	Possible additional pathogens		
	Virus	Virus	Protozoa	Bacteria
Vector-borne	CCHFV (ticks)	TBE (*Ixodes, Dermacentor, Haemaphysalis*)	Leishmaniosis (*Phlebotomus*)	/
	WNV (*Culex*)			
	RVF (*Aedes, Cluex*)			
Non vector-borne	/	Rabies (animals' bite, skratches)	/	Anthrax (food, inhalation, skretches)

Tab 2: Results of the rapid literature review and key stakeholders' preliminary consultation.

- ✓ *Consensus about relevant zoonotic pathogens for Armenia*

During the first workshop the Armenian stakeholders decided to also include Brucellosis and Dirofilariasis to the pathogens identified in Table 2.

- ✓ *Consensus about indicators for the prioritization of the selected pathogens*

The following indicators (Table 3) have been agreed to be used for the prioritisation:

INDICATORS
1. Select the pathogen/s which has/have been detected or caused outbreaks/epidemics in the past 10 years
2. Select the pathogen/s which has/have been detected in a new location or population (human or animal) in the country or neighboring countries in the past 10 years
3. Select the pathogen/s whose animal host (domestic or wild) is/are in close proximity to humans in Armenia
4. Select the pathogen/s whose related vector/s' presence and abundancy are increasing in Armenia due to anthropogenic, climatic and environmental factors
5. Select the pathogen/s that can affect food safety or/and food security
6. Select the pathogen/s which can have a big impact on economic and social aspects in case of outbreak in Armenia
7. Select the pathogen/s which can benefit the most of the integration of the OH approach in preparedness/surveillance/response in Armenia
8. Select the pathogen/s for whom a OH preparedness/surveillance plan is available in Armenia
9. Select the pathogen/s which can benefit the most from the integration of environmental and climatic data in its surveillance
10. Select pathogen/s which has activated a recent response action to contain a potential outbreak of the disease
11. Select the pathogen/s with an integrated (human, veterinarian, environmental) data collection and analysis system in Armenia

Tab 3: Indicators for the prioritisation.

✓ *First polling and discussion*

Questions	CCHFV	RVFV	WNV	I don't know	Total
Select pathogen/s					
which have activated a recent response action to contain a potential outbreak of this disease	0	0	0	4	4
for whom a OH preparedness/surveillance plan is available in Armenia	0	0	0	5	5
which have been detected or caused oubreaks/epidemics in the past 10 years in Armenia	0	0	0	0	0
that can affect food safety or/and food security	3	1	4	3	11
which can benefit the most from the integration of environmental and climatic data in its surveillance	3	2	4	1	10
which can benefit the most of integration of OH approach in preparedness/surveillance/response in Armenia	7	1	4	1	13
which can have a big impact on economic and social aspects in case of outbreak in Armenia	7	5	6	1	19
which have been detected in a new location or population (human or animal) in the country or neighboring countries in the past 10 years	5	0	3	0	8
whose animal host (domestic or wild) is in close proximity to humans in Armenia	4	2	2	2	10
whose related vector/s' presence and abundancy are increasing in Armenia due to anthropogenic, climatic and environmental factors	5	1	2	3	11
with an integrated (human, veterinarian, environmental) data collection and analysis system in Armenia	1	1	1	2	5
	35	**13**	**26**	**22**	**96**

Fig 7: First polling results

Crimean Congo Haemorrhagic Fever was the pathogen that received the highest score (35), followed by West Nile Virus (26) and Rift Valley Virus (13) (Figure 7).

✓ *Second polling and discussion*

Questions	Anthrax	Brucellosis	Dirofilariosis	Leishmaniosis	Rabies	TBE	I don't know	TOTAL
Select pathogen/s								
which have activated a recent response action to contain a potential outbreak of this	5	3	0	1	1	0	0	10
for whom a OH preparedness/surveillance plan is available in Armenia	1	2	0	1	1	1	2	8
which have been detected or caused oubreaks/epidemics in the past 10 years in	3	3	1	1	1	0	1	10
that can affect food safety or/and food security	8	8	0	0	1	1	0	18
which can benefit the most from the integration of environmental and climatic data in	2	1	2	3	0	2	0	10
which can benefit the most of integration of OH approach in	6	6	2	3	3	1	0	21
which can have a big impact on economic and social aspects in case of outbreak in	6	6	0	0	2	1	0	15
which have been detected in a new location or population (human or animal) in the country or neighboring countries in the past 10 years	2	1	1	3	1	1	1	10
whose animal host (domestic or wild) is in close proximity to humans in Armenia	5	5		4	4	1	1	20
whose related vector/s' presence and abundancy are increasing in Armenia due to anthropogenic, climatic and environmental factors	1	3	2	5	0	1	0	12
with an integrated (human, veterinarian, environmental) data collection and analysis system in Armenia	0	0	0	0	0	0	2	2
TOTAL	**39**	**38**	**8**	**21**	**14**	**9**	**7**	**136**

Fig 8: Second polling results

Anthrax was the pathogen that received the highest score (39), followed by Brucellosis (38), Leishmaniosis (21), Rabies (14), Tick Borne Encephalitis (9) and Driofilariosis (8) (Figure 8).

3.4 Conclusion and way forward

Crimean Congo Haemorrhagic Fever was selected as a priority Arboviruses threat for Armenia and it will be considered as a case study to enhance the integration of One Health prevention and preparedness strategies.

Anthrax was selected also in consideration of both recurrent outbreaks and a recent outbreak in the country (Figure 9 and 10) that could have been used as case study to analyse the outbreak response from a One Health perspective utilising the One Health Conceptual Framework.

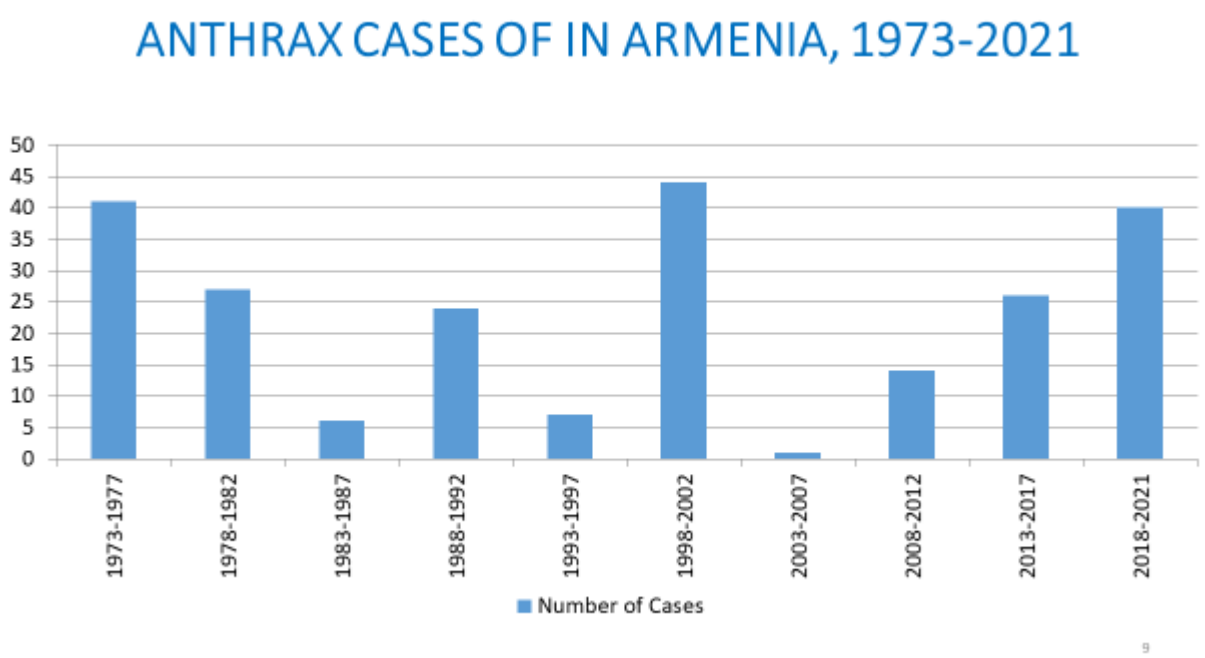


Fig 9: Anthrax cases in Armenia during the years (1973-2021). Source: NCDC- L.Paronyan presentation 2nd Workshop.

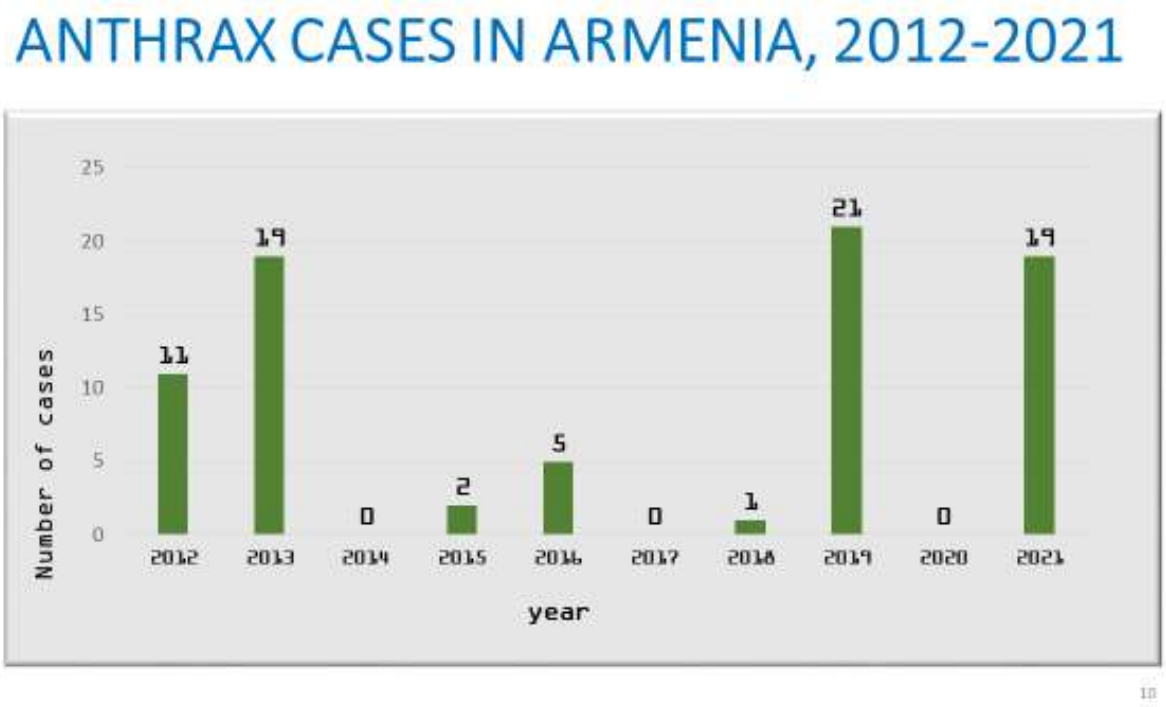
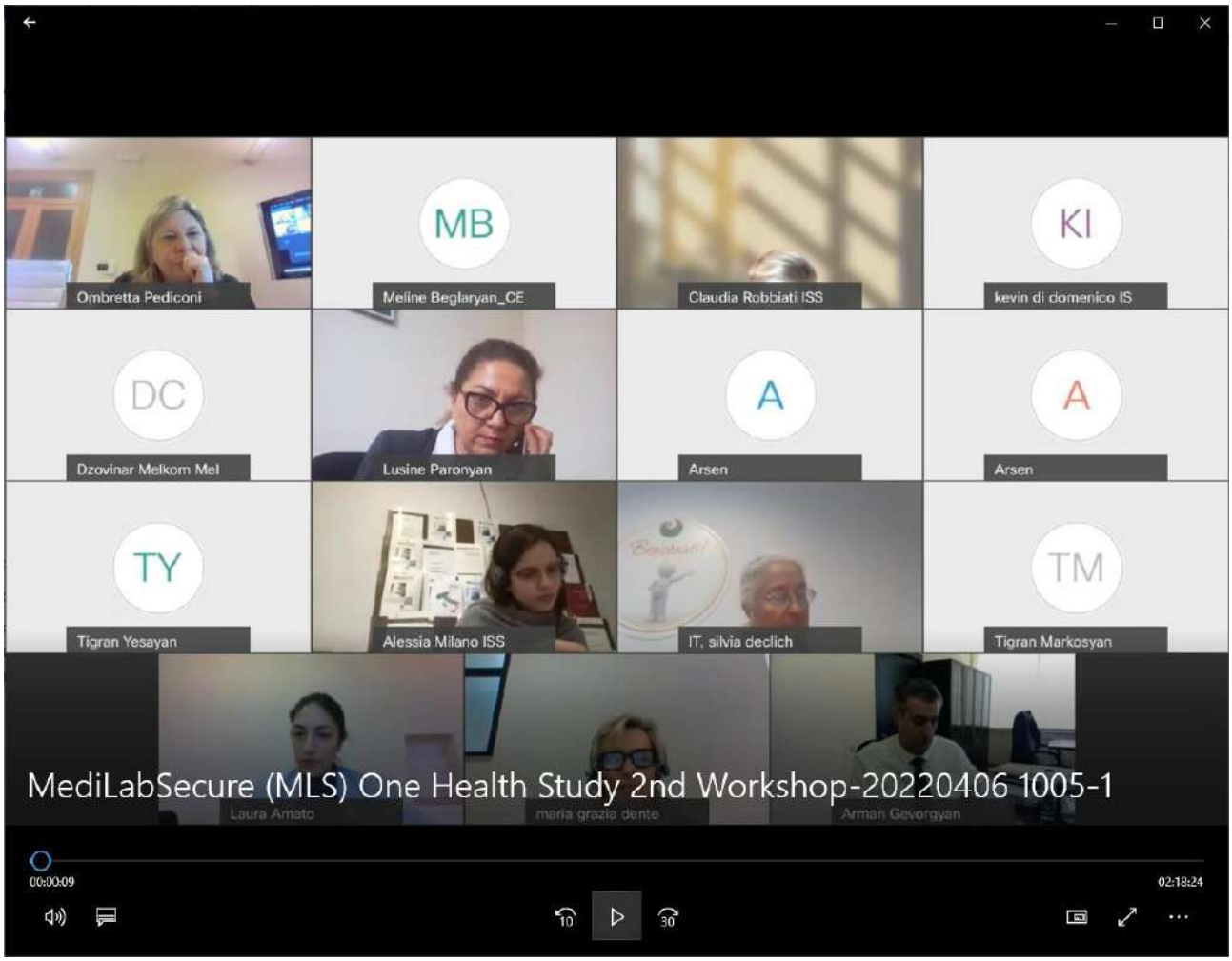


Fig. 10: Anthrax cases in Armenia during the years (2012-2021). Source: NCDC-Paronyan presentation 2nd Study Workshop.

For further details refer to the presentations delivered (Annex 7).

4. SECOND WORKSHOP (6 April 2022)



4.1 Aim and objectives

The aim of the second workshop was to explore existing frameworks at national level regularly used to make the whole system prepared for, and able to prevent, detect and respond to the health threats identified during the first workshop.

In particular, for CCHF/V the **s**urveillance system was analysed to identify aspects of integration between the relevant sectors involved on the basis of the information available on the study portfolio. Aspects unclear or not detailed were share and discussed with the participants.

Regarding response and control strategies for Anthrax, a situation analysis guided by the OH conceptual framework was performed, to highlight aspects of integration and opportunities for improvement.

4.2 Methods

A virtual consultative process with the key stakeholders was performed. The process adopted a participatory approach involving the stakeholders in an active discussion with open-ended questions about the response to the recent outbreak of Anthrax.

The discussion was anticipated by a presentation of Dr Paronyan who reported about the main features of the response activated to control the Anthrax outbreak (Annex 4). The response was analysed and discussed following the One Health Conceptual Framework (figure 11 and 12), a framework that helps in the identification of aspects enabling integration of OH in prevention, preparedness and response strategies.

ONE HEALTH-BASED CONCEPTUAL FRAMEWORK

SCOPE AND PURPOSE OF THE FRAMEWORK						
The present framework aims at guiding the relevant national sectors to implement harmonized and context-driven One Health strategies in the prevention and preparedness to threats to health						
EXPECTED OUTCOME						
Prevention and preparedness plans benefiting from information and data collected and analysed with a One Health approach						
GOAL OF THE STRATEGY						
To facilitate detection of threats at the human–animal–environment interface, assess potential risks for pandemic, support evaluation of possible impacts at system levels and provide back strategies to improve and strengthen prevention						
TARGETS						
National legislative and procedural framework that allows/imposes mainstream One Health approaches in all the prevention strategies and allocates the necessary resources **One Health National Centres**	**Prevention and preparedness plans** developed, implemented and monitored with a One Health approach, including community empowerment strategies, for the prevention and containment of health threats.	**National sectors driven database** interoperable and accessible to all the institutions/sectors involved in the One Health Team	**National training plan on One Health strategies** agreed between institutions and integrated in the relevant national plans	**Evaluation plans** to assess the effectiveness of One Health in reducing the risks of potential epidemics (**prevent**); in supporting the early identification of epidemic risks (**alert**); in contributing to the reduction of the impact (**mitigate**)	International Framework enabling harmonized **integration of One Health strategies in all relevant regulations and communications**	International training plans and tools **aim at facilitating training at na and cross-co level**

Fig 11: The OHCF Targets.

PRIORITIES FOR ACTION						
NATIONAL LEVEL					INTERNATIONAL LEVEL	
Priority 1	Priority 2	Priority 3	Priority 4	Priority 5	Priority 1	Priority 2
GOVERNANCE	PREVENTION AND PREPAREDNESS	DATA COLLECTION AND ANALYSIS	CAPACITY BUILDING	CONSOLIDATION AND EVALUATION OF THE SYSTEM IN PLACE	HARMONIZATION of PLANS AND CROSS BORDER COLLABORATIONS	HARMONISED CAPACITY BUILDING
Establishing a national **multisectoral and multi-institutional team** to set principles, rules and procedures to allow operationalization of One Health strategies. Assessing the opportunity and benefits of setting up a **One Health National Centre (OHNC)** **Enacting laws and identifying resources** for One Health operationalization	Connecting One Health strategies **to prevention and preparedness** plans by establishing a multisectoral team (**One Health Team**)[3] in charge of development, implementation and monitoring of plans	Identification of national **priority areas**[2] to be monitored and related monitoring **indicators/ metrics**[3] Verifying **available sources** of information and data Development of **integrated and interoperable database**[4] connected with early warning and surveillance systems	Development of **training curricula** based on One Health prevention and preparedness Training of staff involved in activities including One Health Strategies Piloting and exercising	Identifying **monitoring and impact indicators** Assessing level of implementation of One Health indications in prevention and pandemic plans Assessing **added value** of One Health in prevention and preparedness	Developing and updating guidance and regulations to integrate One Health strategies in prevention and preparedness plans and **international early warning systems** Identification of **One Health preparedness indicators/metrics** in collaboration with National One Health Teams Establishing WHO/ OIE/FAO[4] tripartite collaborating centres **at One Health National Centres** Facilitating **Networking** opportunities between **One Health National Centres**	**Integration of OH principles** in International trainings for Preparedness and in Tools aimed at assessing level of capacities Promoting harmonised and multi-country exercises

Fig. 12: The OHCF priorities for action.

4.3. Results

- ✓ Crimean Congo Haemorrhagic Virus

The information available in the Portfolio in need of clarification were reported to the stakeholders and the final consolidated information were integrated in the revised Portfolio, which will be integral part of this Report.

Relevant aspects characterising the present situation in Armenia are reported in the tables 4 and 5 (the information was consolidated with the stakeholders during the 3rd Workshop).

- ✓ Integration of One Health approaches in CCHF/V surveillance and early warning

Governance, coordination and communication	Several law acts based on WHO IHR requirements (including Joint Orders and Standard operating Procedures in PH & Veterinary service) Electronic Integrated Diseases Surveillance System (EIDSS) on the way of its implementation. Mechanisms enabling intersectoral activities are not fully in place, e.g. the involved institutions do not have mechanism to regularly share data between sectors. Intersectoral strategies aimed at assessing and addressing relevant risk factors are not fully in place.
Human Health	Arboviral diseases (AD) are notifiable in Armenia. NCDC is responsible for human surveillance. CCHF is in the list of immediate notification. The diagnosis of CCHF is in accordance with EU directives The 170 diseases passive surveillance has been operational in Armenia since 2010, Ministry of Health (MoH) order. It works as case-based surveillance system. Indicator based surveillance system is in place, syndromic surveillance for haemorrhagic fevers and fevers with rash cases are in place. Surveillance for arboviral infections started a long time ago. In 2010, to follow the IHRs, Armenia adopted the MoH order on "Establishment of Epidemiological Rules of Real Time Electronic Surveillance System" that imposes immediate notification of cases to MoH (before it was only urgent notification). The Arboviral diseases surveillance system has never been evaluated. Presently prevention activities on groups at risk for zoonosis are implemented, but CCHF is not included.
Animal Health	No veterinary surveillance system is in place for AD, including CCHF. The reference Institution is the Reference Laboratory Center of EDPs of Food Safety Inspection Body and equipment are generally available, including small quantity of kits for CCHF. They mainly perform activities to adhere to OIE/WOAH policies. An animal identification system online is not operational. Ministry of Economy (Ministry of Agriculture was absorbed by the Ministry of Economy) is in charge to implement it. Food Safety Inspection Body collect data about animal populations and movements and notifies OIE/WOAH every six months with reports with aggregated data. Data about

	populations are available on the National Statistics Agency website. Data about movements (also trade, import/export including wildlife) are not accessible. The Food Safety Inspection Body collaborates with the University of Armenia, but not with private institutions. They also had a collaboration with the Ministry of Environment about African swine fever and avian flu (migratory wild birds) NCDC collaborates with the University of Armenia: two years ago, they did a training for slaughterhouses veterinarians. NCDC collaborates also with Institute of Zoology: the institute performs investigations about wildlife migration (jackals, foxes). NCDC worked with the University of Armenia in project on CCHF ticks for the World Health Alliance (no reports available). Data are shared internally through reports and excel files. These files are not publicly available but they could be available after request for specific objectives.
Medical entomology at NCDC	During a survey in 2016 CCHF virus antigen was detected in 6 tick's species Maps of distribution of ticks were developed at country level. Data are not published, but data and maps can be provided on request for specific objectives. Medical entomologists are regularly conducting field work and data at risk are shared with veterinary service (FSIB), for early detection and prevention. Vector control needs assessment was conducted last year with WHO. NCDC Entomology dept. has a Memorandum of Understanding with Iran and Georgia. With Iran they share information. During CCHF outbreak in Iran in 2018 they didn't collaborate, since the outbreak region was far from Armenia, however medical entomologists from Armenia investigated borders (negative results). They are collaborating with Georgia to develop an atlas of zoonotic diseases not yet published. Potential OH study on tick-borne diseases at the human-animal-environment interface to see the circulation of these pathogens in Armenia in humans and animals are plan ned but not implemented due to lack of resources. Data sharing of ticks' information is done informally with their branches that share awareness among doctors and population about these diseases. Awareness campaigns are not jointly organised with the animal health sector.
Environment	Hydro meteorology and monitoring center is in charge for climate and environment data collection and the Ministries may receive this data that are presently distributed mainly for malaria control

	There are not specific studies about the relationship between environmental data and the presence of arboviral diseases, but they study climate trends. No studies on climate/environment impact on emerging diseases at the moment, maybe in the national OH project that is going to be implemented.

Tab 4: Main features of present situation.

- ✓ Integration of One Health approaches in Anthrax surveillance and early warning

GOVERNANCE

Under WHO International health regulations (IHR-2005) there are 2 multisectoral groups: a high level intersectoral steering committee and an expert group under the MoH (many stakeholders attending the third workshop are part of it).

They were not activated during this outbreak being it a national emergency not under IHR legal framework. For IHR there are specific funds and specific Terms of reference to follow.

They also have government decisions, joint decrees on information exchanging and on actions in case of zoonotic events.

Under the guidance of WHO, NCDC is trying to create a OH Framework for the implementation of the tripartite guide, starting with legislation.

PREVENTION AND PREPAREDNESS

Armenia has not a specific response plan for anthrax, only the generic preparedness one.

Vaccination cost is covered by the government. State covers all the population of cattle every six months and small ruminants once a year. 100% of the animal population for which vaccination is requested is vaccinated based on the statistical data available. Some animals may not be vaccinated because a registration and identification system is not available and only animals for which vaccination is requested are vaccinated.

There are 685 community-veterinarians under the Ministry of Economy. They are mainly veterinarians who work in veterinary services under Ministry of Economy by governmental orders. People with other background can be involved but only for vaccination.

DATA COLLECTION AND ANALYSIS

The entire country is considered at risk, so surveillance activity are not implemented, and effort are focussed on vaccination.

If the communitarian vets see suspected symptoms, they inform the regional offices of government where there is one department that works with farmers.

The institutions are waiting for the Electronic Integrated Diseases Surveillance System (EIDSS) which will collect data of all infectious diseases in both sectors.

The relevant Armenian Institutions involved in Anthrax surveillance are facing problems in creating maps to know anthrax hotspots. Maps were previously available and now the food safety service are in charge for their updating.

CAPACITY BUILDING with One Health approach

Last year a training was arranged (by the National Institute for Health with WHO support) for different disciplines and background: epidemiologists, clinicians of different specialties (such as surgeons, otorhinolaryngologists, oculists, dermatologists and infectionists) and veterinarians.

NCDC is now conducting field epidemiology training with epidemiologists from public and animal health.

A specific intersectoral training curriculum on One Health is not presently available.

CONSOLIDATION AND EVALUATION OF THE SYSTEM IN PLACE

The only evaluation conducted were the JEE in 2016 and OIE evaluation in 2019. In the OIE's evaluation only vets and the food inspectorate addressed the identified gaps.

UTILISATION OF STANDARDISED MANUAL AND TOOL FORM INTERNATIONAL INSTITUTIONS

Armenian relevant institutions and laboratories use laboratory manuals and some publications from FAO and OIE.

In May 2023 there will be a workshop for the implementation of the tripartite.

For further details see the workshop presentations (Annex 5)

5. THIRD WORKSHOP (21 June 2022)

5.1 Aim and objectives

The third workshop aimed at consolidating the information collected during the first two workshops and at performing a feasibility assessment of opportunities for the integration of the OH approach in prevention, preparedness and response strategies.

5.2 Methods

First a consultative process to fill the gaps in the information collected was performed. Then a feasibility assessment of opportunities for the integration of the OH approach, which emerged during the first two workshops, was carried out using virtual polls, involving key relevant experts from human health, animal health, entomology, and representatives of the Jacobs Armenia. The following scale was used for the feasibility assessment:

Feasibility scale regarding perceived barriers to implementation

Score	Rate	% of chance of feasibility
0	Not feasible	0
1	Very poor	20%
2	Poor	40%
3	Medium	60%
4	Good	80%
5	Very good	100%

5.3 Results

The results of the feasibility assessment are reported according to their score of feasibility.

- ✓ Opportunities to enhance the One Health system for CCHF/V

↑**Intersectoriality**	**Feasibility score**
Governance	
Preparedness plans with a OH approach	4
Leveraging on WHO IHR requirements to enhance intersectoral activities at national level (e.g. exploiting bodies/committee established for IHR for national priorities; integrated risk assessment; etc.)	3.8
Multisectoral Training Curriculum on One Health	3.8
Operationalisation	
Include climate and environmental data and identify trends and drivers	3.8
Prioritize training on Electronic Integrated Diseases Surveillance System (EIDSS) transversally to all sectors involved at national and peripheral levels	3.8
Education and awareness campaigns involving all the sectors (One Health)	3.3

Tab 6: Opportunities to enhance the One Health system.

- ✓ Opportunities to enhance CCHF/V preparedness & early warning

↑**Early warning**	**Feasibility score**
Human and Animal surveillance	
Cross-sectional serological surveys on domestic animals (especially ruminants) to define areas exposed to the virus infections	4.5
Surveillance of ticks infestations in domestic animals in at risk areas	4

Vector mapping	
Consolidate maps of distribution of ticks in the country as potential vectors of arboviral diseases and identify priority areas to be monitored	4.5
Risk assessment	
Serological surveys on humans/Groups at risk to define areas exposed to the virus infections	4.8
Collecting and analysis data to monitor risk groups, risk areas and at-risk events	4.3

Tab 7: Opportunities to enhance CCHF/V preparedness & early warning.

- ✓ Opportunities to enhance Anthrax preparedness & early warning

↑Prevention and early warning	**Feasibility score**
Identification of drivers	
Study in detail enhancing drivers of Anthrax in order to guide prevention actions (e.g. OH KAP Survey on Anthrax)	4.5
Community engagement	
Communitarian vets more involved in preparedness and prevention actions (e.g.. vaccination)	4.5

Tab 8: Opportunities to enhance Anthrax preparedness & early warning.

6. DISCUSSION

The third workshop highlighted some opportunities to enhance the One Health system, particularly preparedness and early warning strategies both for CCHF/V and for Anthrax. The opportunities that scored 4 (80% of chance of feasibility) or more in the stakeholder-led process, were considered as feasible with minor barriers.

For CCHF/V the stakeholders judged feasible the development of a preparedness plan for Arboviruses outbreaks with a OH approach. Cross-sectional serological surveys on domestic animals (especially ruminants) to define areas exposed to the virus infections and surveillance of tick's infestation in domestic animals in at risk areas were described as feasible to improve early warning activities. Consolidate maps of distribution of ticks in the country and identify priority areas to be monitored were also voted as feasible to improve prevention and surveillance. To improve risk assessment strategies, serological surveys on humans/groups at risk could be performed to define areas exposed to the virus infections. Also, integrated data collection and analysis to monitor risk groups, risk areas and at-risk events was described as feasible.

The evaluation of the Anthrax response with the OHCF suggested few opportunities to improve Anthrax preparedness with a OH approach. Two opportunities were judged as feasible (score 4 or more), namely study enhancing Anthrax drivers identification in order to guide prevention actions (e.g. OH KAP Survey on Anthrax) and engage ccommunitarian vets in preparedness and prevention actions (e.g. vaccination).
The opportunities with low score were discussed with the stakeholders. It emerges that the barriers preventing the implementation of some activities with an integrated approach, like for example training involving different disciplines, are due to procedural aspects like the requirements of the training credits that are still established and attributed by the different sectors and disciplines without any transversal harmonization.
Efforts are in place in Armenia to overcome these constraints, as for the "One Health" frontline Field Epidemiology Training Programme (FETP), started in 2021, where 3 cohorts graduated with 20 frontline epidemiologists and 17 veterinarians. The 4th cohort will start in September. Also in the Eastern European/South Caucasus Intermediate FETP, Armenia participates with two epidemiologist and two veterinarians.

For further details see the workshop presentations (Annex 8)

7. CONCLUSION AND WAY FORWARD

The OHMESAPLUS study was a participatory process of knowledge co-production to consolidate the OH approach in prevention, preparedness and response to CCHF/V and Anthrax.

CCHV/F preparedness and response system was outlined and the feasibility of opportunities to improve these strategies with a OH approach were assessed by the stakeholders. At the governance level a OH preparedness plan to improve surveillance and early-warning was deemed feasible including serological surveys in humans and animals, vector mapping, multisectoral data collection and analysis (table 9).

Anthrax outbreak response was assessed with the OHCF and the opportunities to improve prevention and preparedness with a OH approach were identified as study Anthrax drivers and engage community vets in prevention activities (table 10).

The OH approach could be promoted through the highlighted opportunities to support outbreaks prevention, preparedness and response strategies in Armenia, if communication and sharing of data among the different sectors is routinely implemented.

Feasible opportunities to enhance CCHF/V preparedness & early warning
Preparedness plans with a OH approach
Cross-sectional serological surveys on domestic animals (especially ruminants) to define areas exposed to the virus infections
Surveillance of tick's infestation in domestic animals in at risk areas
Consolidate maps of distribution of ticks in the country as potential vectors of arboviral diseases and identify priority areas to be monitored
Serological surveys on humans/Groups at risk to define areas exposed to the virus infections
Collecting and analysis data to monitor risk groups, risk areas and at-risk events

Tab 9: Feasible 0pportunities to enhance CCHF/V preparedness & early warning.

Feasible opportunities to enhance Anthrax preparedness & early warning
Study in detail enhancing drivers of Anthrax in order to guide prevention actions (e.g. OH KAP Survey on Anthrax)
Communitarian vets more involved in preparedness and prevention actions (e.g. vaccination)

Tab 10: Feasible opportunities to enhance Anthrax preparedness & early warning.

In addition, with the discussions implemented with the relevant stakeholders the following aspects were underlined to enhance control of zoonotic diseases with a One Health approach:

- To improve mutual information both at the national level and between the regional subdivisions of the Human Health and Veterinary Services, ensure real-time data exchange for joint risk assessment, analysis, to organize complex activities within the framework of "one health";
- Monitor the health status of animals, including in terms of zoonotic diseases, ensure early detection of cases among animals, proper removal of carcasses, organize the complete burning of fallen animals, excluding the entry of dogs, other animals into the animal buries, decontamination of the territory and used items;
- Prohibit the slaughter of fallen animals, tighten restrictive measures against the movement of animals and meat products;
- Improve the vaccination of animals (how did it happen that so many vaccinated animals became infected)?
- Also, it is needed to provide veterinarians with personal protective equipment.

8. REFERENCES

1. Gevorgyan H, Grigoryan G, A. Atoyan H, Rukhkyan M, Hakobyan A, Zakaryan H et al. Evidence of Crimean-Congo Haemorrhagic Fever Virus Occurrence in Ixodi¬dae Ticks of Armenia. Journal of Arthropod-Borne Diseases. 2019;

2. Fanelli, A, Tizzani, P, Buonavoglia, D. Crimean–Congo Haemorrhagic Fever (CCHF) in animals: Global characterization and evolution from 2006 to 2019. *Transbound Emerg Dis*. 2021; 00: 1– 12. https://doi.org/10.1111/tbed.14120

3. Sahak M, Arifi F, Saeedzai S. Descriptive epidemiology of Crimean-Congo Hemorrhagic Fever (CCHF) in Afghanistan: Reported cases to National Surveillance System, 2016–2018. International Journal of Infectious Diseases. 2019;88:135-140.

4. FAO. National Framework for One Health [Internet]. 2021. Available from: https://www.fao.org/3/cb4072en/cb4072en.pdf

5. Report of the NATIONAL VECTOR CONTROL NEEDS ASSESSMENT (VCNA) IN ARMENIA, Prepared by National Center for Disease Control and Prevention Working Group 2021

6. OIE, WHO. National Bridging Workshop on the International Health Regulations (IHR) and the OIE Performance of Veterinary Services (PVS) Pathway [Internet]. 2019. Available from: https://extranet.who.int/sph/sites/default/files/NBW%20Armenia%20-%20Final%20Report.pdf

7. WHO. Joint External Evaluation of IHR Core Capacities of the Republic of Armenia [Internet]. 2016. Available from: https://www.who.int/publications/i/item/WHO-WHE-CPI-2017.14

8. BENGIS R, FREAN J. Anthrax as an example of the One Health concept. Revue Scientifique et Technique de l'OIE. 2014;33(2):593-604.

9. Paronyan L, Zardaryan E, Bakunts V, Gevorgyan Z, Asoyan V, Apresyan H et al. A retrospective chart review study to describe selected zoonotic and arboviral etiologies in hospitalized febrile patients in the Republic of Armenia. BMC Infectious Diseases. 2016;16(1).

10. Sweeney D, Hicks C, Cui X, Eichacker P. Anthrax Infection. American journal of respiratory and critical care medicine [Internet]. 2011 [cited 14 June 2022];184(12):1333-1341. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3361358/

11. Fanelli A, Tizzani P, Buonavoglia D. Crimean–Congo Haemorrhagic Fever (CCHF) in animals: Global characterization and evolution from 2006 to 2019. Transboundary and Emerging Diseases. 2021;69(3):1556-1567.

12. Dente M, Riccardo F, Nacca G, Ranghiasci A, Escadafal C, Gaayeb L et al. Strengthening Preparedness for Arbovirus Infections in Mediterranean and Black Sea Countries: A Conceptual Framework to Assess Integrated Surveillance in the Context of the One Health Strategy. International Journal of Environmental Research and Public Health. 2018;15(3):489.

13. Esser H, Mögling R, Cleton N, van der Jeugd H, Sprong H, Stroo A et al. Risk factors associated with sustained circulation of six zoonotic arboviruses: a systematic review for selection of surveillance sites in non-endemic areas. Parasites & Vectors. 2019;12(1).

14. Ghai R, Wallace R, Kile J, Shoemaker T, Vieira A, Negron M et al. A generalizable one health framework for the control of zoonotic diseases. Scientific Reports. 2022;12(1).

15. The University of British Columbia. A Comparative Analysis of One Health Policies in Asia: Opportunities for Application in British Columbia [Internet]. 2022. Available from: https://www.onehealthcommission.org/documents/filelibrary/news/narratives_of_oh_in_action/42222_Compara_Analysis_OH_PoliciesA_2DD13CB47D6C0.pdf

Additional consulted references

- Use of a One Health approach for understanding the epidemiology and management of anthrax outbreaks in the human-livestock-wildlife and environmental health interface areas of Northern Tanzania. https://hdl.handle.net/11250/2651171
- One Health approach for elimination of human anthrax in a tribal district of Odisha: Study protocol. https://doi.org/10.1371/journal.pone.0251041
- Risk factors associated with the occurrence of anthrax outbreaks in livestock in the country of Georgia: A case-control investigation 2013-2015. https://doi.org/10.1371/journal.pone.0215228
- Risk factors for human anthrax outbreak in Kiruhura District, Southwestern Uganda: a population-based case control study. https://www.one-health.panafrican-med-journal.com/content/article/5/13/full
- Unexpected human cases of cutaneous anthrax in Latium region, Italy, August 2017: integrated human–animal investigation of epidemiological, clinical, microbiological and ecological factors. https://www.eurosurveillance.org/content/10.2807/1560-7917.ES.2019.24.24.1800685?crawler=true