Toward a One Health Surveillance System in Cuba: Co-Productive Stakeholder Engagement

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The case presented in this manuscript illustrates a cross-sectoral and transdisciplinary approach involving stakeholders and researchers in a first step toward the design of two Integrated Surveillance Systems in Cuba: one for Influenza viruses with zoonotic potential and one for Antimicrobial Resistance. We applied a Constellation Analysis, a visual tool that enabled us to gather novel information using a participatory approach. As a next step, we will use the outcomes of this study to guide the development of Integrated Surveillance Systems following a One Health approach.

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Abstract

We advocate for a holistic approach to building resilience against health hazards in Cuba by improving cross-sectoral and transdisciplinary collaboration. As a step in this direction, we conducted participatory workshops to design two One Health Surveillance Systems (OHSS): (i) for Influenza viruses with zoonotic/pandemic potential and (ii) for Antimicrobial Resistance (AMR). We engaged multiple stakeholders and used a Constellation Analysis (CA) tool to identify and visualize the elements of the ongoing veterinary and public health surveillance systems that are currently in place for AMR and Influenza. The stakeholders also delivered innovative insights regarding their views on the future OHSS. The participatory workshops consisted of four stages: (1) description of the case studies and their impact in Cuba; (2) validation of pre-designed CAs; (3) focus group discussions about the future OHSS; and (4) listing and discussing essential action points to develop and implement an OHSS. The workshops encompassed several group discussions and plenary sessions. The discussions were guided by a set of questions and supported by the CA tool. In both studies, we found that the transdisciplinary approach of the CA was suitable for encouraging group and plenary discussions. Stakeholder engagement is essential for the co-production of viable solutions to address complex health problems. Overall, this case illustrates how transdisciplinary research enables rapid co-production of knowledge among stakeholders that can [AU 2] inform both policy and practice.

What is the Incremental Value that Makes this a One Health Case?

The One Health characteristic of this case lies in its transdisciplinary and participatory nature. Two participatory workshops were conducted to engage stakeholders and decision makers to move toward a future model for an Influenza-OHSS and AMR-OHSS in Cuba. Extensive collaboration with animal, environment, and public health, across disciplines (microbiologists, virologists, epidemiologists, agricultural producers, veterinarians, physicians, pharmacologists, food specialists, and environmentalists) and sectors (academic, government, pharmaceutical industry, food industry, and regulatory agencies) was used to address two important One Health challenges: zoonotic influenza and AMR. For the first time in Cuba, these stakeholders exchanged, in a lively and structured way, ideas about these One Health hazards. We used a participatory tool, Constellation Analysis (CA), to generate an in-depth understanding of the current and potential future elements relevant to the development and implementation of OHSS in Cuba. Based on the established collaboration across disciplines and sectors, the network and findings of the CA will be used as a basis for the design of the future Influenza-OHSS and AMR-OHSS.

Learning Outcomes

1. A cross-sectoral and transdisciplinary workshop is beneficial for holistically discussing the topic of OHSS. Pre-designing a visual tool (e.g. CA) helps to encourage discussion between stakeholders.
2. Constellation Analysis is useful for analyzing complex systems through the systematic evaluation of four key system elements: actors, natural elements, technical elements, and signs/symbols. The CA requires limited training by the participants, is user-friendly, enables concept visualization, and can be applied to diverse problems (not only health-related). The CA favors the visualization of involved elements and only requires papers, pens, and post-its to be implemented.
3. Using a CA is beneficial for identifying the strengths and weaknesses of a surveillance system as demonstrated by the two Cuban cases presented.
4. Political will, ecosystem health data, intersectoral collaboration, mechanisms for immediate sharing of information, and legal or regulatory frameworks were found to be crucial for achieving surveillance system integration.

Background and Context

One Health surveillance is strongly encouraged at global, national, and local levels efficiently manage health hazards (Bordier *et al*., 2020). However, most surveillance systems are implemented separately for the human and animal health sectors (Wendt *et al*., 2015). The Quadripartite Alliance between the World Health Organization (WHO), the Food and Agriculture Organization of the United Nations (FAO), the World Organization for Animal Health (WOAH), and the United Nations Environment Program (UNEP) is promoting a strategic framework to advance sector-specific and multisectoral One Health approaches for zoonotic diseases, as well as to integrated antimicrobial resistance (AMR) surveillance and control (WHO *et al*., 2022).

The Challenge of Influenza in Cuba and Cuban Surveillance Activities

Influenza A viruses can be classified depending on the original host (e.g. avian influenza, swine influenza, human influenza). Some of these viruses are zoonotic (H1N1, H5N1, H7N9, H9N2). In addition, the persistence of highly pathogenic avian influenza (HPAIV) A virus and the emergence and persistence of multiple new HPAIVs in Asia, the Americas, and Europe in 2022 raised global concern about their zoonotic/pandemic potential (Mosaad *et al*., 2023). [AU 3]

In Cuba, influenza infection behaves as an endemic disease in humans, with a cyclical behavior of annual epidemic outbreaks and sporadic cases throughout the year. Human influenza is associated with pneumonia and is currently the fourth leading cause of death in all age groups in Cuba (Peláez *et al*., 2018). This is not the case for the avian influenza virus, which is exotic to Cuba, despite its high risk of introduction through migratory birds, mainly from the Atlantic and Mississippi corridors (Ferrer *et al*., 2014). Intersectoral collaboration for the investigation of outbreaks or suspicion of zoonotic diseases is mandatory in Cuba (CDN, 2023). However, the public and animal health sectors have independent surveillance systems for influenza virus. [AU 4]

The Challenge of Antimicrobial Resistance in Cuba and Cuban Surveillance Activities

AMR is an ecological problem characterized by complex interactions of diverse microbial populations, affecting the health of humans, animals, and the environment (Collignon and McEwen, 2019). Antimicrobial overuse and misuse occur across multiple sectors increasing the AMR threat (O'Neill, 2015).

Several studies in Cuba have addressed the identification of AMR in zoonotic pathogens in multiple settings (Quiñones *et al*., 2020; Quiñones Pérez *et al*., 2020; Baez *et al*., 2021; Barroso González *et al*., 2021; Hernández-Fillor *et al*., 2021). Multiple actions have been prioritized to identify AMR of clinical interest in Cuba. AMR is one of the priorities of the Governmental Project ″One Health application in the national sanitary strategy for sustainable development″ (Presidencia y Gobierno de la República de Cuba, 2021). However, surveillance activities aimed at tackling AMR at the human–animal–environment interface have not been implemented in Cuba.

Problem Statement and Constellation Analysis as a Participatory Tool for One Health Surveillance System Assessment

The Cuban One Health strategy, developed in 2021, aims to strengthen capabilities to fight global health hazards in prioritized areas, such as surveillance and diagnostics, AMR, zoonoses, and food safety. It does not aim to duplicate efforts already existing but to establish alliances between sectors and institutions, with the effect of optimizing resources and harmonizing work approaches. Therefore, there is currently a favorable environment for the development of integrated surveillance systems for both case studies.

In this project, a participatory workshop engaging diverse stakeholders was conducted, aiming to support the Cuban One Health Strategy in the development of One Health Surveillance System (OHSS). For this workshop, a tool called Constellation Analysis (CA) was used. CA is a methodological approach for facilitating inter- and transdisciplinary cooperation. This tool "increases reciprocal understanding of different perspectives among participating stakeholders, and allows for the expression of different points of view through strategic approaches as a special form of validation" (Ohlhorst and Schön, 2015).

Cross-Sectoral and Transdisciplinary Process

Our research team was supported by a specialist in transdisciplinary approaches (from the Swiss td-net[1]) to support the creation and development of the Constellation Analysis (CA). A CA aims to create a transparent, mutually accepted visualization of elements of the system and their inter-relationships, forming a cohesive cluster. The use of a CA in a stakeholder workshop allows for the identification of common ground and points of consensus. Even if there is not a unanimous consensus, the CA helps pave the way for informed decision making, while facilitating a negotiated process (Schäfer, 2022).

The CA focuses on the relationships of four types of elements relevant to a specific complex problem of interest. The element categories are actors (stakeholders, e.g. animal producers, research and academic institutions, government), signs and symbols (e.g. legal framework, plans and programs, regulations), natural elements (e.g. climate, vegetation, and animal species), and technical elements (e.g. information system, databases). First, elements are identified and arranged visually on a board supported by brainstorming and discussion sessions. The identification of relevant elements can also be supported by literature synthesis. The mapping of elements is usually done by using differently colored and shaped cards to enable flexible and visual arrangement. Then, the type of connections between the elements, if any, is discussed and visualized as being: directed, conflictive, nonexistent, contradictory, reluctant, or interactive.

Workshop Preparation Phase

Before the workshops, the research team received two training sessions about the concept and use of the CA provided by the td-net expert. The team then developed two separate CAs for Influenza and AMR (Fig. 1). These were based on the surveillance activities currently in place in Cuba. Subsequently, the CAs were presented during the workshops and further assessed by all stakeholders.

The research team identified various stakeholders, aiming at engaging a diverse group of participants who could contribute to a holistic knowledge of the current system and vision for future systems. The cross-sectoral and transdisciplinary nature of the workshops were reflected in the broad representation of sectors and disciplines relevant to the cases. The Influenza and AMR workshops had 36 and 32 participants, respectively. The participants worked at various institutions at national and regional levels (Table 1). Representatives from livestock state producers, the veterinary pharmaceutical industry, and researchers from biology and ornithology science were also invited but unfortunately were not able to participate because of other work commitments. Therefore, to compensate for this limitation and to capture the insights of these stakeholders, their participation will be taken into consideration in a future expert elicitation conducted via a questionnaire.

[1] The Network for Transdisciplinary Research (td-net) links scientific communities, supports transdisciplinary careers and promotes the development of competencies and methods. On the web portal for co-producing knowledge (Available at: www.transdisciplinarity.ch/toolbox) it shares step-by-step procedures and experience reports of transdisciplinary tools and methods, including the constellation analysis.

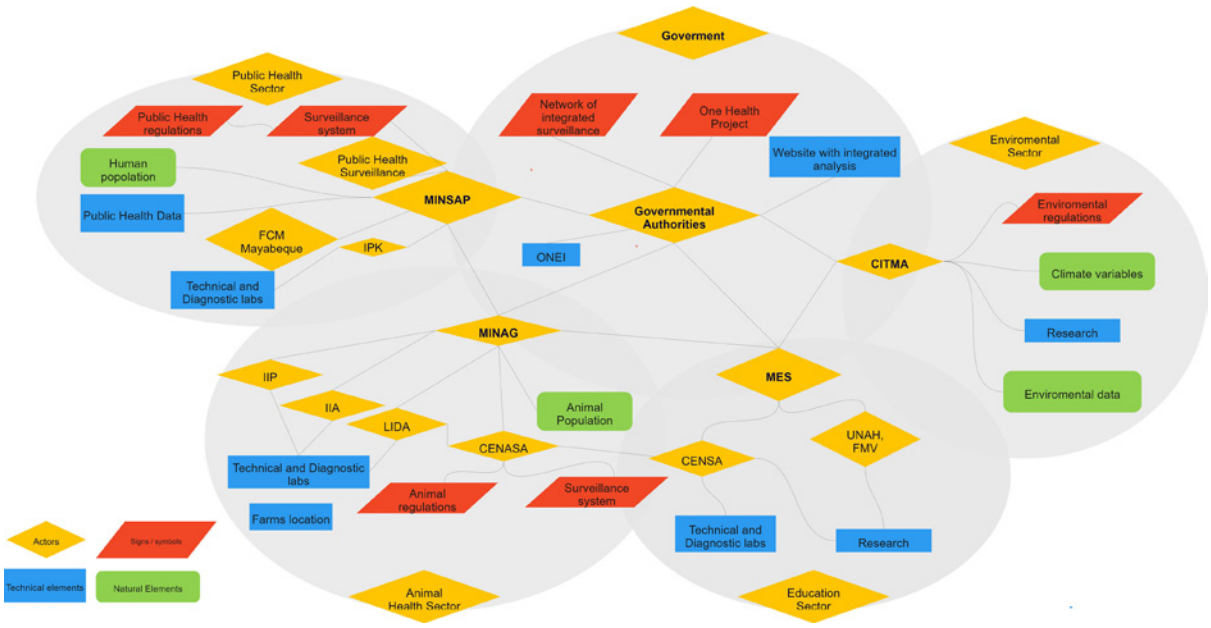

Fig. 1. Summary of the common elements in the constellations presented for both cases (Influenza and AMR).

Table 1. Description of the stakeholders involved in the participatory workshops in Cuba.

Professional sector	Discipline/specialty	Stakeholders' profession and activities	Influenza No. participants	AMR No. participants
Public health	Epidemiology, health policy, microbiology, food analysis, academics	Surveillance, food inspection, laboratory diagnosis, decision makers, data report, research, epidemiology field	10	10
Higher education	Avian medicine, epidemiology, microbiology, physician, veterinary	Professors, researchers, laboratory diagnosis, data sharing	9	9
Animal health, agriculture	Microbiology, veterinary, epidemiology, virology	Surveillance, data report, laboratory diagnosis, producers, legislation, research, academic	8	5
Environmental sciences	Microbiology, veterinary, biochemical	Regulation and legislation, surveillance	1	2
Food industry	Microbiology, food analysis	Producers, laboratory diagnosis, food inspection	1	2
Pharmacy	Pharmaceutics, pharmacology	Pharmaceuticals—producers, distribution, decision makers	2	2
Civil defense	Epidemiology, microbiology diagnostic	Decision makers, regulation, and legislation	3	2

Workshop Program and Execution

The workshops were held on September 13 (Influenza) and 14 (AMR), 2022, in Havana, Cuba, lasting for a full day each (8 h with a lunch break). The audience consisted of native Spanish speakers, and the workshops were conducted in Spanish. English translations were provided to the research team when needed. The results were recorded in Spanish and translated to English afterward. The workshops' program and the main questions addressed in each session are presented in the supplementary material.

The workshop program consisted of four stages: (i) description of the case study challenges in Cuba, (ii) validation of the pre-designed CA, (iii) focus group discussion on future Influenza-OHSS and AMR-OHSS, and (iv) listing and discussing of essential actions that must be taken toward the development and implementation of an OHSS.

The stakeholders were divided into three groups of 10 people each, with representatives of different sectors well distributed between the groups to balance the representation of sectors among groups. A facilitator from the research team was assigned to each group. The facilitators guaranteed that all team members understood the questions and tasks, ensured that all were involved and able to express their thoughts, and clarified doubts when necessary. In addition, a designated observer in each group from the participants took notes and recorded the discussions among stakeholders. Before starting the workshop, stakeholders were informed that data gathered during the workshop would be treated confidentially and that any results published would be anonymized. Verbal consent was obtained from each participant.

First Stage: Introduction and Presentations

Following the self-introduction of the participants and research team, a first survey was applied for both cases in order to assess the knowledge of the participants at the beginning of the workshop. Furthermore, three introductory videos about the One Health concept (WHOA, 2022), AMR (PAHO, 2020), and Influenza (WHO, 2022a) were displayed. PowerPoint presentations were shown to the participant, related to the One Health approach, Influenza virus, AMR, integrated surveillance system, and CA.

Second Stage: Validation of the Pre-Designed CA

In this session, the participants worked directly with the CA tool. It consisted of discussions among stakeholders on their impression and completeness of the CA that was previously designed by the research team (Fig. 1). The CA included different elements that are relevant for surveillance. In addition, the relationships (present, absent, and type of relationship) between all the elements were represented. Through group discussion, stakeholders added missing elements, deleted elements that they thought were not relevant to the system, and added links between the elements, whenever they were considered to be necessary. After group work, each of the three groups presented their findings to the plenary. This was followed by a general discussion.

[AU 5] Three Stage: Group Discussion about a Future OHSS

The group discussion targeted the conception of an ideal integrated One Health surveillance system for each of the two case studies in Cuba. Based on the CA developed and assessed in stage 2, the strengths and weaknesses of the current systems were identified. Through this process, the needs for cross-sectoral collaboration, as well as the main action points to consider for the design and implementation of an ideal Influenza-OHSS and AMR-OHSS, respectively, were identified and discussed.

In the Influenza case, for which non-integrated surveillance systems already exist, a discussion about the design of OHSS was carried out in the plenary, after its preparation in the groups. At the end of the work session, a second survey was conducted to identify elements that were key to the design and implementation of an integrated Influenza-OHSS.

In the AMR workshop, after the discussion about the ideal AMR-OHSS, stakeholders were asked to identify useful information for an *Escherichia coli* AMR-OHSS. As suggested by the WHO, *Escherichia coli* was used as an indicator microorganism for monitoring AMR (WHO, 2021). At the end of the workshop, a survey was conducted to assess the stakeholders' perceptions regarding AMR-OHSS comparing the responses to the surveys implemented at the beginning of workshop. After the workshops, a report for each case was written to collect all information and summarize it.

Fifteen participants contributed in both workshops, which allowed them to be more familiarized with the method. However, the facilitators always kept attention that they did not exercise a strong leadership role within the groups in order to not affect the participatory discussion. In this case, they showed a greater speed, understanding, and interpretation of the exercise compared to the rest of the participants who were presenting themselves for the first time. This favored the development of the discussion being more concise with the arguments expressed and even allowed the time budgeted for each activity within the program to be met.

Project's Impact

Participatory workshops are effective methods for enhancing mutual understanding, connecting people interested in the topic, and improving communication and collaboration between participants (Nygrén, 2019).

Stakeholders were introduced to the CA for the first time during the workshops. Participants agreed that the methodology was very promising as it raises awareness and organizes information in an effective and visually appealing way. Specifically for complex problems with various elements, such as a surveillance system, there was a general agreement that it is an excellent method to create an editable draft, as well as to define the importance of the elements according to their location within the constellation. The most important elements can be placed in the middle of the visualization and the relationships between them are depicted, whereas less important elements can be placed more peripheral. Consequently, the CA can be considered to be a practical working, communication, and visualization tool, as it stimulated discussion and fostered a common understanding between participants. In addition, the CA can be used to represent different problems and is compatible with other participatory approach methods, such as brainstorming.

Challenges of the CA Tool:

- CA is work-intensive post-workshop, as all resulting CA's need to be merged into one, which can be quite arduous.
- Training is required to work with this methodology as it is quite complex. It needs a clear understanding of what belongs to the different elements.
- It needs to be adapted to each country's context plus governmental organization/structure.
- It requires a meeting with the stakeholders, which can be hard to organize since it is time-consuming for the participants and can be costly (in case there are many stakeholders joining the workshop). Moreover, since a one-day workshop is required to ensure that the stakeholders grasp the full advantages of the method, time can be a limiting factor for its use.
- It displays a moment in time (those stakeholders, at that time) and it is constantly evolving.

Different outcomes were obtained in each workshop using the same CA method. The CA that was modified and finally approved by the stakeholders is presented in Fig. 2.

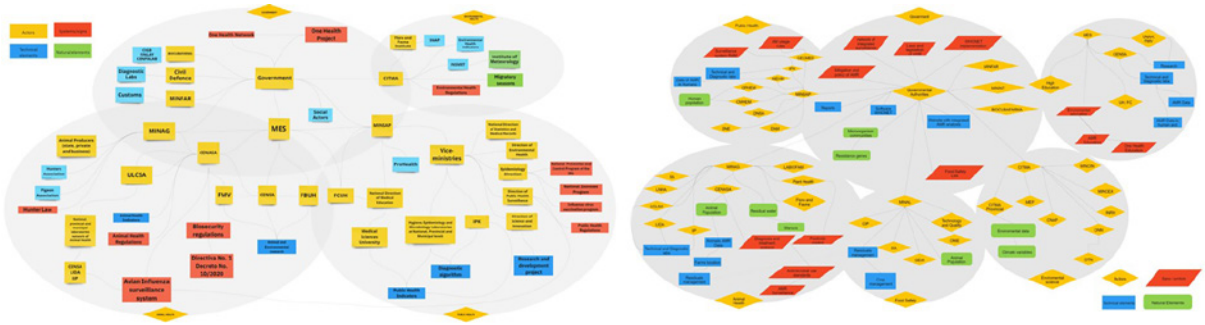

Fig. 2. Constellations Analysis generated by participants in the morning session for each case study.

Influenza Workshop Impacts

During the group discussions, the three groups advocated adding new elements to the pre-designed CA. These were social organizations (such as the Federation of Cuban Women (FMC) and National Association of Small Farmers (ANAP)), pharmaceutical industry, importers of diagnostic supplies as actors, which suggested new legislations on animal health diagnostics, protection of areas, and nature reserves. In addition, some research institutions, agencies in charge of inspections and sanitary surveillance, and laboratories with high levels of biosecurity in Cuba were suggested to be added. Two of the groups agreed on the inclusion of institutions that provide geographic and spatial information, such as GEOCUBA. This information can be integrated into a holistic "One Health" analysis, as well as into hazard, vulnerability, and risk studies for disaster response. One of the groups suggested the inclusion of fisheries research institutions, due to the susceptibility of aquatic mammals to infection by influenza A viruses. All groups mentioned the inclusion of natural elements, such as climatological variables. The list of technical elements identified *a priori* by the research team required several modifications. There was broad consensus on the inclusion of information related to health issues that come from social organizations: Cuban Wome's Federation (FMC) and National Association of Smallholders (ANAP), given their role in early warning. [AU 6] They have collaborated with public health and other sectors on multiple occasions to collect health data,

disseminate information, conduct surveys, and provide support in vaccination campaigns, even though their main objective is not to collect information for health.

Divergences between groups were found mainly regarding the elements "symbols and signs." One of the groups gave greater importance to these elements for the proper functioning of the surveillance system, while the other two groups considered the actors pivotal for the system. The direction of some of the direct relationships established between actors and other elements was modified (e.g. biosecurity regulations were removed from livestock producers, and the relationship between the medical science university and the Ministry of Higher Education (MES) was deleted). These relationships between actors and elements were defined before the workshop by the research team. After the transdisciplinary process and plenary discussion, it became clear that some input from the workshop participants differed from the CA developed by the researchers. In the final CA, we adopted the input that was provided by the group of participants.

Suppression of elements defined by the research team in the initial system was mainly related to the relationships between elements and technical components. Two of the three working groups removed five relationships between certain actors, meaning they could not identify any exchange of information between them. Furthermore, participants considered that the relationship between animal producers and public health surveillance groups was not accurately represented in signs associated with preventive measures (i.e. biosecurity standards, vaccination campaigns) and substituted the proposed technical elements (public health and research data, and technical and diagnostic laboratories) with the terms public health indicators and diagnostic algorithms.

The main findings of the plenary session about the weaknesses of the current surveillance systems for influenza viruses in Cuba were the following:

1. Despite the existence of established mechanisms to join efforts between Public and Animal Health in the event of an emergency or health threat, there is a deficiency in intersectoral integration for diagnostic protocols and recording of data and sharing information.
2. Information flows vertically between regulatory and primary organizations, which hinders the continuous horizontal flow of intra- and intersectoral information at different levels and feedback between institutions in different sectors. Such a gap leads to poor dissemination and communication of monitoring results between health sectors.
3. Regulatory mechanisms that clarify the role of each institution/actor within the frame of an intersectoral surveillance strategy are lacking and needed.
4. There are fragilities in the current surveillance systems, namely scarcity of technical personnel and diagnostic facilities**.**
5. There is suboptimal training at the undergraduate and graduate levels in subjects related to the One Health approach.

Participants were asked to define three key aspects of developing and implementing the OHSS. The responses can be summarized in five categories (Fig. 3). The policy included political will and regulatory

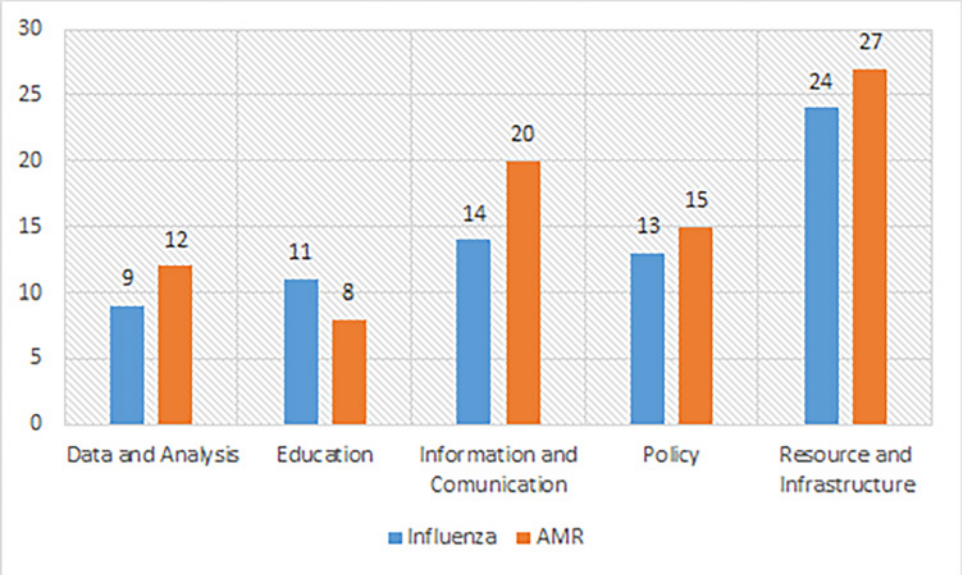

Fig. 3. Frequency of the mentioned aspects to consider while developing and implementing the OHSS.

framework; resources and infrastructure are intersectoral work, optimization of resources, computer tools, monitoring, surveillance; education included training, and sensitization; information and communication are communication flow, feedback, traceability, and availability of information; and data and analysis are comprehensive reports on species of interest and climatological aspects. "Resource and Infrastructure," "Information and communication," and "Policy" represented 75% of all the mentions during the exercise, standing out as key elements for the development of an ISS using a One Health approach.

These elements were identified after the collaborative and transdisciplinary discussion. Throughout the workshop, various concepts such as the One Health approach, integrated surveillance systems, and the differences between "data" and "information" were presented and discussed in depth with the participants. After these clarifications, stakeholders developed a better understanding of a CA as a participatory method, and of the objectives proposed for the workshop.

AMR Workshop Impacts

The workshop created awareness on the need for an AMR-OHSS in Cuba and changed stakeholders' perceptions on the integrated One Health Surveillance System and the benefits of sharing information. Stakeholders increased their knowledge on One Health and Integrated Surveillance. In the beginning, the most commonly used terms were "sector," "disease," and "interface." At the end of the workshop, stakeholders identified some key concepts, such as "cross-sectoral" and "integrated interfaces," that focus on improving cross-sectoral collaborations required for integrated surveillance of AMR. Moreover, participants emphasized the inclusion of the food industry, water resources, antimicrobial distributors, public health, and agriculture, environmental, and animal health sectors in the workshop in Cuba. Additionally, the "flow of information" regarding the diagnosis of antimicrobial susceptibility in patients among health sectors was identified as a key factor to support "decision making" in prevention and rapid response. The CA was useful to motivate stakeholders' involvement and promote discussion. The group discussion highlighted actors and institutions as the most important elements of the surveillance system.

New insights gained from the stakeholders were the importance of adding GEOCUBA, responsible for the provision of geo-referenced data, to the actors, with the aim of contributing through spatial analysis to the identification of priority areas for intervention; the need to include the Institute of Hydraulic Resources to mitigate the AMR spread through water was suggested. It was perceived to be important for environmental monitoring to provide vital information for assessing AMR transmission and antibiotic resistance gene circulation (Liguori *et al*., 2022). Stakeholders shifted the control of antimicrobial distribution, from the public health sector to the pharmaceutical producer actors. Relationships between institutions from animal and plant health, as well as to the agriculture sector, were added. In contrast, a relationship between agriculture and environmental sciences was eliminated following consensus among the participants. Finally, the food industry was identified as an independent sector from agriculture, with five new institutions from the food industry added to the CA as new actor elements.

The participants reached a consensus on what type of information should be collected by an AMR-OHSS, specifically on the indicator bacteria *Escherichia coli*. This led to eight recommendations or action points to be implemented throughout the sectors to expand the cross-sectoral collaboration:

1. Health-related sectors need to focus on monitoring the usage of widely used animal and public health antimicrobials: Beta Lactamases, Carbapenems, Cephalosporins, Fluoroquinolones, Colistin, Linezolid, Aminoglycosides, Tetracyclines.
2. Standardization of methods for AMR diagnosis is necessary. For territorial or regional laboratories, the Kirby-Bauer technique was suggested, while for national laboratories, the Minimum Inhibitory Concentration (MIC) was the recommended methodology. Moreover, genomic sequencing techniques were suggested.
3. The regional laboratories should provide qualitative data (antimicrobial susceptibility test: susceptible, resistance, or intermediate resistance) and transfer them to national and reference laboratories, while national laboratories focus on quantitative data production.
4. The reporting of the incidence, prevalence, and mortality in different species associated with AMR, as well as identified resistance genes, should be mandatory at the national level. The timeliness and frequency at which data should be reported depends on hazard characteristics, from immediate to annual reporting. Data analysis should be performed on a national and regional level to identify spatial and temporal trends.

5. An IT server is needed to support the data sharing and analysis of antimicrobial susceptibility and resistance data. Official approval of WHONET software (WHO, 2022b) can increase collaboration between sectors.
6. Reference laboratories in charge of reporting or sharing the antimicrobial susceptibility data should be accredited and participate in proficiency essays to demonstrate the quality of their results.
7. Legislation for monitoring AMR in the environment is needed to increase the mitigation of industry residues, biocides, and heavy metals.
8. The development of the National AMR Action Plan should be supported by legislation.

Similar Outcomes in Both Workshops

Participants strongly acknowledged the implementation of an OHSS as a key priority for tackling health hazards in Cuba. They highlighted that surveillance activities take place in several institutions without exchange of information. Therefore, the need to improve data sharing among stakeholders involved in Influenza and AMR management was emphasized as one of the main concerns. In terms of how information should be shared between institutions, participants identified several challenges (Box 1).

Box 1. Challenges identified by stakeholders during the workshop group discussion

- Official procedure currently implemented in Cuba for the exchange of information weakens integration among sectors.
- Type of data and information to be shared among institutions, both qualitative and quantitative, needs to be defined (e.g. epidemiological and health indicators, circulating pathogen subtypes, pathogenicity, antimicrobial susceptibility, focal or risk areas).
- Immediate sharing of information among sectors in the case of a health emergency through direct channels (e.g. telephone, mail) is needed.
- A common access platform is vital to make information readily available for institutions and producers.
- Better communication channels are required, for example reports, bulletins, web pages, and newsletters.
- Laboratory resources to maintain a surveillance plan in the different sectors are necessary.

Despite these challenges, several aspects in Cuban society increase the chances for the success of OHSS. The Cuban health system has governmental support and promotes One Health approaches, and there are already collaboration agreements in place between the institutions in the event of health emergencies. In addition, there are people who are experienced in the design and implementation of surveillance and monitoring systems for both case studies, and there are institutions and personnel trained in early detection and timely diagnosis. Moreover, international collaborations and networks exist with One Health experts that can be used to support the design and implementation of integrated surveillance systems.

Increasing the capacity/experience of Cuban experts in the use of these methods within a One Health approach and integration opens the door for their use in the future. Training will increase the awareness and commitment of stakeholders and decision makers to the importance of implementing an integrated surveillance system, which will pay dividends in the medium term rather than shortly after implementation.

The new surveillance system does not require replacing the existing ones, which align with the responsibilities and functions of each sector. This is considered advantageous, as each institution plays a crucial role within the system. The focus should be on determining the degree of integration with which cooperative actions will be developed in response to specific findings or trends. Cooperative actions include joint sampling and diagnosis, data collection and analysis, or reporting and communication of results. The study should also identify the need to establish under-utilized cross-sectoral communication channels and identify the needs for joint action on specific issues. The greatest threat may be the lack of resources to implement new practices. However, there are opportunities to optimize the monitoring process through the degree of integration and cooperation that in turn saves resources.

We cannot be sure that a transdisciplinary designed monitoring system will perform better than a conventional one because of its immediacy, as the functioning of such systems depends on different factors and interests of economic, social, and governmental actors and decision makers, as well as on the particular historical moment or situation in a given country. Direct communication with decision makers throughout the system-designing process could facilitate the implementation of the final result, as they are the key persons to make use of the results based on scientific evidence and transdisciplinary methods. The cost of carrying out surveillance under this new management, and the complexity of the system to be implemented must also be taken into account, both of which are issues that in complex situations could tip the balance toward a return to isolated approaches and the prioritization of one sector over another.

Project Outlook

The participatory workshop raised awareness of One Health Surveillance among stakeholders and can be used to further enhance transdisciplinary collaboration in Cuba, which is in line with the Cuban Health governmental national project. Next steps include an institutionalization of a new partnership across the environment, animal, and public health sectors to increase cross-sectoral collaboration and quantitative and qualitative data sharing among institutions.

A workshop with international experts will be conducted to validate and discuss the results of this case study. The aim of that workshop will be to follow up on the results of the Cuba participatory workshops, focusing on the discussion on the design of OHSS in Cuba.

A technical brief should be elaborated pointing out the strengths and opportunities for improvement that were identified, allowing us to strengthen capacities among stakeholders and promote the exchange of information gathered during the participatory workshop among Cuban academics, institutions, industries, and governments.

The key findings of this study will be disseminated through national and international conferences.

Conclusions

The participatory approach enabled the participants to highlight the importance of supporting the OHSS concept, the interaction between sectors and the need for actions (information in real-time, legislation, technological alignment, training, and harmonization of diagnostic algorithms) that foster successful collaborations.

The use of CA was successful and has shown its potential to lay a basis for further design of OHSS.

The participatory exercise fostered understanding and cooperation between institutions, disciplines, and sectors, as expressed by the participants in their feedback during and after the workshop. Moreover, it demonstrated that both challenges and opportunities exist for the development of integrated surveillance systems in Cuba.

The participatory workshops for both cases identified additional actors and institutions to be engaged in the process and determined the information required on antimicrobial monitoring, susceptibility tests, and key regulations to develop One Health Surveillance Systems. The outcomes emphasized the need to prioritize the creation of new legislation that allows data sharing among institutions.

Acknowledgments

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The data presented is unavailable due to ethical reasons. Therefore, data cannot be shared before previous authorization from workshop participants. Requests to access the data should be directed to palfonso2014@gmail.com [AU 7]

Conflict of Interest

The authors declare no conflict of interests.

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