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One Health surveillance – More than a buzz word?

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Abstract

One Health surveillance describes the systematic collection, validation, analysis, interpretation of data and dissemination of information collected on humans, animals and the environment to inform decisions for more effective, evidence- and system-based health interventions. During the second International Conference on Animal Health Surveillance (ICAHS) in Havana, Cuba, a panel discussion was organised to discuss the relevance of One Health in the context of surveillance. A number of success stories were presented which generally focused on the obvious interfaces between human and veterinary medicine such as zoonoses and food safety. Activities aimed at strengthening inter-sectoral networking through technical collaboration, conferences, workshops and consultations have resulted in recommendations to advance the One Health concept. There are also several One Health educational programmes offered as Masters programmes. Continuing challenges to One Health surveillance were identified at both technical as well as organisational level. It was acknowledged that the public health sector and the environmental sector could be engaged more in One Health activities. Legal issues, hurdles to data sharing, unclear responsibilities and structural barriers between ministries prevent integrated action. Policy makers in the health sector often perceive One Health as a veterinary-driven initiative that is not particularly relevant to their priority problems. Whilst some funding schemes allow for the employment of scientists and technicians for research projects, the development of a sustainable One Health workforce has yet to be broadly demonstrated. Funding opportunities do not explicitly promote the development of One Health surveillance systems. In addition, organisational, legal and administrative barriers may prevent operational implementation. Strategies and communication across sectors need to be aligned. Whilst at the technical or local level the formal separation can be bridged, separate funding sources and budgets can jeopardise the overall strategy, especially if funding cuts are later required. To overcome such challenges, a strong business case for One Health surveillance is needed. This should include the costs and benefits of One Health activities or projects including consequences of different strategies as well as risks. Integrated training should also be further promoted. Future ICAHS conferences should continue to provide a platform for

discussing surveillance in the One Health context and to provide a forum for surveillance professionals from all relevant sectors to interact.

1. Introduction

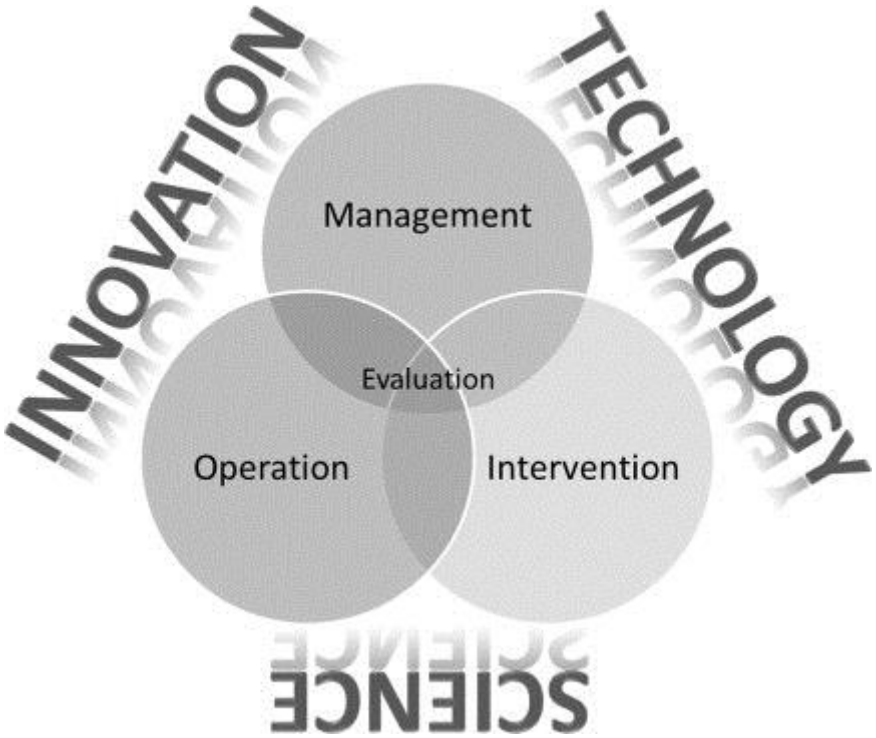
"One Health" is a term that is used increasingly in a range of different contexts. There are several conferences held at regular intervals with a One Health focus (e.g. One Health Summit; International One Health Congress; International One Health Conference; International Conference on One Medicine One Science). A panel discussion was held during the second International Conference on Animal Health Surveillance (ICAHS) in Havana, Cuba to discuss the relevance of One Health in the context of surveillance. Here we aim to summarise that discussion. The authors were all members or facilitators of the panel.

Whilst we acknowledge the usefulness of an accepted definition of One Health surveillance, the time available at ICAHS did not allow for the in-depth discussion such a topic requires and therefore this was deliberately excluded by the panel. Building on general definition of surveillance, we propose to use the term as follows:

> *One Health surveillance describes the systematic collection, validation, analysis, interpretation of data and dissemination of information collected on humans, animals and the environment to inform decisions for more effective, evidence- and system-based health interventions.*

The panel discussion was recorded and notes were also taken. The following summary is not only based on notes but also includes additional examples, references and points contributed by the authors after the conference. This discussion can be structured around the different activities relevant to surveillance (Fig. 1). These include the operational aspects such as field implementation, sampling and laboratory activities. We also consider the management component which is relevant at different levels (local, regional, national), including strategic, legal and communication aspects. Finally, there is an important interface with interventions because surveillance rarely achieves a benefit on its own

66 but should be considered jointly with interventions (Häsler et al., 2011; Howe et al., 2013). This latter
67 point was also highlighted in the panel discussion. Innovation in technological and scientific
68 approaches is relevant in relation to any of the fields shaping future surveillance.



69

70 Fig. 1. Aspects considered in the discussion of the current status and challenges for One Health surveillance.
71 Surveillance is understood to inform interventions; the latter are therefore also included.

72 2. One Health surveillance: where are we?

73 During the ICAHS panel discussion, a number of examples of collaborative surveillance activities were
74 mentioned that are conducted under the One Health umbrella (Goutard et al., 2015; Ward and
75 Hernandez-Jover, 2015). The current success stories generally focus on the obvious interfaces
76 between human and veterinary medicine such as zoonoses and food safety. One specific published
77 example is the joint implementation of surveillance for brucellosis in Mongolia in which sero-
78 surveillance in people and monitoring of achieved vaccination coverage in livestock is conducted
79 jointly with technical staff of both sectors, and in Kyrgyzstan joint brucellosis surveillance in people
80 and livestock provided the basis for the development of an inter-sectoral cost-effective control

81 strategy (Zinsstag et al., 2009). Thus there is an opportunity for surveillance systems for brucellosis in
82 cattle only – such as one presented by Bronner et al. (2015) at ICAHS – to be linked to human health
83 surveillance to increase benefit.

84 Successful One Health collaboration in surveillance was also reported in conjunction with infectious
85 disease outbreaks. During one of the largest multi-country, food-borne outbreaks in Europe, many
86 aspects of collaborative surveillance were discussed and recommendations made for improvements
87 (Beutin and Martin, 2012). Also, examples of successful surveillance collaboration were reported
88 during ICAHS for influenza (Bruhn et al., 2014) and for rabies (Mtema et al., 2014; Ward and
89 Hernandez-Jover, 2015; Townsend et al., 2014). Such collaboration is, however, not necessarily
90 common in animal influenza surveillance. A recent survey on national and regional animal influenza
91 surveillance systems implemented worldwide revealed that, in the instance of influenza-positive
92 poultry or pigs being identified, the public health sector would be alerted only in some occasions (Von
93 Dobschuetz et al., 2014). Opportunities for closer collaboration in influenza surveillance were
94 confirmed at ICAHS (Durr et al., 2015; Paul et al., 2015).

95 Triggered by incidents such as the threat of a global influenza pandemic, a number of high-level, multi-
96 lateral activities were initiated by the Food and Agriculture Organisation (FAO), the World Health
97 Organisation (WHO) and the World Organisation for Animal Health (OIE). These activities aimed to
98 strengthen inter-sectoral networking through technical activities, conferences, workshops and
99 consultations and have resulted in recommendations to advance the One Health concept.[1,2,3,4,5] A
100 further specific example of the international collaboration supported by OIE and FAO in practice and
101 policy making of One Health, is the OIE and FAO network of expertise on animal influenza (OFFLU).
102 This global network covers the exchange of scientific data and biological materials, provides technical
103 advice and veterinary expertise, discusses research needs, and assures collaboration. OFFLU formally
104 contributes to the WHO Consultation on the Composition of Influenza Virus Vaccines. Furthermore
105 OFFLU established an expert group for swine influenza which has membership from both the

106 veterinary and the public health sectors. The major task of this group is to compile SIV surveillance
107 and virus data worldwide and monitor SIV evolution.

108 Collaborative action is often easier to achieve at the local level. Nevertheless, often medical and
109 veterinary data recording remain largely separate and therefore a lot of potentially useful information
110 and knowledge sources are left untapped. An important step towards integrated surveillance has been
111 achieved by aggregating databases at the human-animal interface; for example the GLEWS database[6]
112 includes animal or zoonotic disease events for which information has been jointly gathered by FAO,
113 OIE and WHO and confirmed by the national authorities. OFFLU is connected with national monitoring
114 networks, in particular with the Influenza Virus Monitoring Network (IVM) recently established in
115 Indonesia[7] (Wibawa et al., 2014), composed of more than 10 laboratory members, which collectively
116 monitor the emergence of possible variant influenza viruses in poultry. Such country networks can be
117 instrumental in ensuring continuous influenza vaccine efficacy in poultry and arguably a model for
118 other countries. The public health sector benefits from the outcomes of such monitoring networks.
119 Another example of collaborative action at the local level is the establishment of the "4-way linking"
120 platforms8 in three countries (Egypt, Vietnam and Indonesia) for joint public health-animal health risk
121 assessment based on data from epidemiology units as well as laboratories. At ICAHS, Ward and
122 Hernandez-Jover (2015) present a generic risk assessment tool for rabies which relies of inputs from
123 both animal and human health; its use requires a collaborative approach.

124 In Canada, information on risk factors and prevalence and resistance data for pathogens causing
125 enteric diseases are collected along the food chain including animal and human sampling. The utility
126 of the integration of information can be demonstrated, particularly in terms of early detection of
127 emerging threats (Deckert et al., 2010; Parmley et al., 2014). Similarly, in Europe the agency
128 responsible for animal health and food safety (EFSA) and the agency responsible for public health
129 (ECDC) are jointly producing the annual zoonoses report.[9] These agencies also increasingly collaborate
130 around outbreaks, for example the emergence of Schmallenberg virus.[10] Vectorborne disease

surveillance is an area in which a One Health approach is often possible. At ICAHS, Ezanno et al. (2015) described a generic weather-driven model to predict the risk of mosquito-borne disease transmission. To operationalise such a tool, input is required from both animal and human health sectors, with environmental factors being obvious drivers of the system ultimately developed.

In terms of education and training, there have been a number of One Health courses and University programmes launched. Examples include the Masters in One Health programme delivered jointly by the Royal Veterinary College and London School of Hygiene and Tropical Medicine,[11] the Master of Science One Health programme offered by the University of Edinburgh,[12] the University of Florida's Masters in Health Sciences with One Health concentration and PhD in Public Health with One Health concentration[13] and the new University of California Global Health Institute (UCGHI) Masters in Global Health degree programme with a One Health track, to commence in 2016.[14] Under the Regional Field Epidemiology Training Program for Veterinary (FETPV) adapted and supported by FAO and partners in the Asia region, 'One Health' training courses have been organised. In China, the Chinese Field Epidemiology Training Program (CFETP) and the FETPV have held joint training sessions and in Thailand key linkages have been established between the Thai FETPV and the FETP. Going one step further, the Mongolian FETP programme since 2014 includes participants from the medical and veterinary sectors in a fully joint training course.

These programmes do not specifically focus on surveillance, but do count on the links with surveillance units. All such programmes appear to have been developed only recently, mostly within the past 5 years. The employment opportunities of graduates, as promoted by the programmes, tend to be either in operational aspects such as outbreak investigations ("graduates will have the knowledge and skills to be able to respond rapidly and effectively to outbreaks of disease as well as controlling endemic disease at the interface between humans, animals and the environment[11]") or in the area of public policy ("the programme will enable students to … bring much-needed attention to the policy and operational issues that ultimately will be key determinants for success[12]").

In addition to technical training, there are also programmes focusing on general leadership and networking. For example, the University of Minnesota runs a programme on engaging with international organisations and academic institutions from across the globe with a specific focus on One Health.[15] In the Caribbean, the European Union funded project "One Health, One Caribbean, One Love" will include a 2-year One Health Leadership Series for young to mid-career professionals from the agriculture, health and environment sectors. Organised by PAHO/WHO and the University of the West Indies, the programme will include technical and leadership training, mentoring and One Health project formulation and management. Examples of regional networks include the South East Asia One Health University Network (SEAOHUN) and One Health Central and Eastern Africa (OHCEA) Network. These networks are funded through the USAID emerging pandemic threats programme (EPT) and focus on general capacity building, including surveillance. The scope, however, is specifically on infectious zoonotic diseases; in addition, these networks are limited to academic institutions and do not involve regulatory institutions that are under the authority of veterinary services or under the ministry of health.

The Global Health Security agenda[16] has recently been launched by the USA and has already been endorsed by over 40 countries. It acknowledges the need to integrate human and animal health interventions to better prevent, detect and control human diseases. This programme aims at strengthening country compliance with the International Health Regulations[17] and can potentially generate collaborations, surveillance, interventions, research, and improved policies through a One Health approach (Jones et al., 2008).

3. What are the main gaps and challenges

Many continuing challenges were discussed at the ICAHS conference. These included both technical as well as organisational issues. It was acknowledged that the public health sector could be engaged more in One Health activities. Legal issues, hurdles to data sharing, unclear responsibilities, structural barriers between Ministries of Health, Agriculture and the Environment/Natural Resources and a lack

of communication were all raised as obstacles to progress. In terms of data sharing, FAO, OIE and WHO have been working collaboratively in effectively implementing a framework to promote cooperation between human and animal surveillance systems for analysing available evidence and evaluating responses and the timely sharing of comparable epidemiological and pathogen data across the relevant sectors.[18]

When planning to engage the public sector, one of the most important issues to consider is the legal basis. Over several years, the OIE developed an approach aimed at strengthening Veterinary Services (VS) in all its components for improving animal and public health, through its PVS Pathway.[19] An important conclusion of these evaluations has been the great need for appropriate legal basis of VS worldwide. When operating surveillance systems within the One Health perspective, all countries need to acknowledge and implement mechanisms to assure a legal basis for these joint surveillance activities. In countries where the "4-way linking" assessment missions have been operational, real-time sharing of information at the field level was often functionally possible and accepted, if not desired, between human and animal health local officers; however the barrier to sharing was at the policy level where the necessary support was not in place to allow full sharing of all information. At ICAHS, an encouraging example was also presented on cross-sectorial collaboration in Mongolia (Wieland et al., 2015).

In the Caribbean, PAHO/WHO and FAO developed a One Health policy for the region.[20] Whilst it was relatively easy to obtain support in the agricultural livestock sector, this was more challenging in the health sector, where the priorities are quite different (focus on non-communicable diseases, childhood obesity and mental health). The policy makers in the health sector often perceive One Health as a veterinary-driven initiative that is not particularly relevant to their priority problems. In addition, we have yet to fully capture the ecosystem health sector in the One Health approach. However, the significant effect of climate change on public health, animal and ecosystem health in the

205 Caribbean constitutes a powerful argument for One Health surveillance with information sharing
206 across the three sectors.

207 Some notable funding programmes have been initiated which either directly address research on One
208 Health surveillance, or which incorporate One Health principles into surveillance programmes. Some
209 recent examples include the call for research on Zoonoses and Emerging Livestock Systems (UK), the
210 Canadian call on Ecosystem approaches to the better management of zoonotic emerging infectious
211 diseases in the Southeast Asia region and the Gates Foundation's Grand Challenge in One Health.
212 These funding opportunities have been targeted at research in developing countries and often focused
213 on specific zoonotic diseases, such as brucellosis, trypanosomiasis and tuberculosis. Whilst funding
214 may be used to employ researchers and technicians, the development of a sustainable One Health
215 workforce has yet to be broadly demonstrated. In general, current funding opportunities do not
216 explicitly promote the development of One Health surveillance systems. One of the barriers to funding
217 One Health surveillance – whether in developed or developing countries – is a widely held belief that
218 such activities are in the national interest (protection and promotion of national trade in livestock and
219 livestock products, and improvement of the health of the local human population) and therefore
220 should be funded by national governments. There is a need to differ between research funding and
221 funding to develop the necessary societal infrastructure which is lacking in the developed world
222 perhaps even more than in the developing world. Although One Health surveillance systems are
223 promoted by international organisations, funding mechanisms are largely absent and surveillance
224 remains insufficient in many fields and in many regions. Regional approaches to disease surveillance
225 exist – for example in the case of foot-and-mouth disease in Southern Africa and Southeast Asia or
226 classical swine fever in Latin America and the Caribbean – but similar examples of regional One Health
227 surveillance systems are rare. As described by Goutard et al. (2015) at ICAHS, a combination of
228 participatory methods and modern technologies could help to overcome the constraints inherent to
229 the low-income countries.

In addition to funding, organisational and structural barriers may prevent the operational implementation of One Health surveillance. The importance of different priorities between Ministries of Health and Agriculture becomes apparent when it comes to joint control strategies. For example, legal and administrative hurdles hinder approval of a joint brucellosis control strategy in Mongolia. In such situations it is therefore critical that the separate strategies are aligned and that communication across sectors ensures consistency from implementation to monitoring of the strategy. Whilst at the technical level and even at the local level, this formal separation can be overcome through strengthened collaboration of technical personal, separate funding lines can jeopardise the overall strategy, especially if budget cuts are required.

In the Caribbean, when trying to promote joint planning and budgeting between Ministries of Health and Agriculture for inter-sectoral activities at the interface, some professionals have replied that this is impossible. However, in Trinidad and Tobago, this problem was circumvented by forming a cabinet-appointed multi-sectoral task force on zoonotic diseases, in which joint planning and budgeting are done. Another example of organisational integration is in Switzerland where the newly formed Federal Food Safety and Veterinary Office facilitates formal collaboration between the sectors. Although budgetary separation from the Federal Office of Public Health remains, the two agencies at least report to the same minister.

Partnership between the public and private sector is a key element for disease prevention, detection and control. The animal industry may conduct their own surveillance for diseases that may be zoonotic and have their own vaccination programmes against specific diseases. The barriers of information sharing between the private and the public sectors is quite specific to the animal sector, due to commerce of animals and their products; however these barriers may have negative health

consequences as public health interventions may be delayed. It is well documented with H5N1 HPAI and H7N9 LPAI influenza viruses that human activities and behaviours (i.e., trading and marketing) are significant factors in disease spread and persistence in domestic poultry. The animal health sector and the public health sector therefore ought to take into account human behaviours and actions in their risk-based surveillance and risk assessment activities. Both sectors can take the opportunity to learn from each other and plan joint activities. For example, the USDA as part of their influenza surveillance21,22 has developed mechanisms for anonymous sharing of SIV isolates by the US swine industry with public veterinary laboratories; this mechanism ensures sharing of useful information for both the animal and public health sector whilst protecting swine trade interests. A study presented at ICAHS (Paul et al., 2015) suggests how social anthropology methods can be used to better understand reasons for suboptimal avian influenza surveillance.

In some countries, substantial surveillance efforts are conducted by the private sector. For example, in Switzerland, the poultry industry conducts surveillance for zoonotic hazards such as Campylobacter contamination. However, these data are not shared with other decision makers, notably the veterinary services. This is seen as a missed opportunity as already collected data would be of added value to official programmes. Some countries such as Sweden have overcome this barrier such that industry-driven surveillance is funded by government and therefore becomes a collaborative activity with data sharing.

4. What is needed to progress One Health surveillance

An important conclusion discussed by the panel was the “beer-and-pizza concept” (as mentioned by Professor Craig Stephen, Univ. of Calgary, during the ICAHS conference). This was described as using incentives for professionals from different backgrounds to meet in a relaxed and friendly environment. This should help build relationships in a neutral issue-free environment that may be essential in a future crisis situation. It was also indicated that the next generation of surveillance professionals may be more open to communicate informally and to trust their peers. There is also an important role for

conferences such as ICAHS to promote dialogue and opportunities for exchange. It was, however, also indicated that the variety of competing One Health conferences was unhelpful to shape and focus the One Health community.

To put more convincing arguments in front of hesitant policy makers, investors, managers and colleagues, a strong business case for One Health surveillance was requested, a need that has been acknowledged for some time (Hueston et al., 2013; Grace, 2014). This should include the costs and benefits of One Health activities or projects including potential consequences of different strategies as well as risks (Anonymous, 2012). One Health surveillance should lead to faster disease detection, more efficient disease control and tangible financial savings when formally compared against separated surveillance streams. Specifically for surveillance, a project was presented at ICAHS which considers the economic aspects of cross-sectoral surveillance (Babo Martins et al., 2014). A recent review on One Health metrics also identified many examples that demonstrated the added value of One Health, but also confirmed the lack of systematic recording and metrics of benefits (Häsler et al., 2014). To move towards development of useful metrics, small specific projects should be more successful in demonstrating tangible benefits than big vague concepts. It is expected that many more examples will be presented at the next ICAHS. Thus, we should be able to quantify if and when One Health surveillance can add value.

ICAHS participants were in agreement that organisational solutions favouring One Health surveillance will take time, although some positive examples are already available. Typically, organisational structures will adapt more quickly after a crisis situation. For example, the struggle with bovine spongiform encephalopathy led to the creation of the European Food Safety Authority (EFSA). Also several European countries consequentially re-organised their authorities related to food (e.g. Austria, Germany, Switzerland, UK), thus integrating veterinary and public health aspects in a stable-to-table approach. Joint budgets certainly enhance joined-up high-level decision making. However, the focus

on food alone is not enough. Wider collaboration is required across offices and ministries as well as at international level. The FAO, WHO and OIE have signed a tripartite agreement to cooperate on issues at the human animal interface.[23]

The One Health approach and policy for surveillance has progressed in both the developing and the developed world. The developing world faces major increases of human and animal populations and densities with a trend for closer interactions between these human and animal populations, including wildlife. The developing world also faces severe gaps in surveillance in general, and in epidemiological knowledge and robust laboratory competency in particular. Although the developing world has progressed in One Health, One Health surveillance still needs to be translated at local and community level where policies are operationalised (Anonymous, 2013).

Health training has suffered the effect of "silos" in the same way that efforts to address human health, animal health and environmental health have become artificially segregated within the government or academic sector. More than 100 years ago, medical training was broad; with the advent of specialisation in the latter part of the 20th Century, particularly the medical and veterinary sciences became separated. An ideal, albeit long-term, approach to promoting One Health is to train medical, veterinary and environmental scientists in partly overlapping curricula whilst recognising that each will pursue different career pathways. Although a handful of One Health-focused postgraduate programmes have been established, their sustainability and career chances for their graduates are yet to be demonstrated. Training at an undergraduate level, in which the inter-relatedness of medical, veterinary and environmental sciences is promoted, arguably would have a much larger and long-term impact and create the conditions in which One Health surveillance would become an obvious solution to addressing a wide range of problems we currently face. An ideal case study would be antimicrobial resistance surveillance, where part of the responsibility lies in the agricultural veterinary and medical realm, but also has environmental implications via waste management routes.

The view was expressed at ICAHS that it was important to acknowledge that not everybody had to work with all sectors in order to assure that the key objectives relevant to One Health were pursued. Such inter-sectoral collaboration is likely to be essential in some areas whilst it is irrelevant for others. The priority should be that the relevant work is done effectively and efficiently.

Finally, it was suggested that future ICAHS conferences should continue to provide a platform for discussing surveillance in the One Health context. The invitation of keynote speakers with medical and environmental backgrounds should be assured for the continuing challenge of the mainly veterinary audience. Hopefully, discussions around terminology will also progress over the coming years in order to avoid the ongoing confusion and uncertainty on practical consequences of the One Health approach.

Conflict of interest statement

The authors declare no conflicts of interest. The views expressed in this information product are those of the authors and do not necessarily reflect the views or policies of FAO.

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