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EMPRES
EMERGENCY PREVENTION SYSTEM

FAO develops strategies to curb the economic damage caused by peste des petits ruminants (PPR)

The Food and Agriculture Organization of the United Nations (FAO) recently organized two workshops in Addis Ababa, Ethiopia, to work with development partners in East Africa to map out strategies to curb the economic damage caused by the deadly PPR, also known as "goat plague". The meeting put in motion the first steps towards creating a regional initiative in the Horn of Africa that would prevent and control the spread of PPR across borders (page 2).

Goats grazing in Msanga Villlage, United Republic of Tanzania

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Towards the Global Control of Foot-and-Mouth Disease (FMD)

A Global Conference on Foot-and-Mouth Disease Control took place in Bangkok, Thailand from 27 to 29 June 2012. The conference aims were to present the global status of FMD in its endemic setting and stimulate global efforts to enforce and harmonize control of the disease. A global strategy for FMD control was jointly prepared by the FAO/World Organisation for Animal Health (OIE) FMD working group appointed under the umbrella of the Global Framework for the Progressive Control of Transboundary Animal Diseases (GF-TADs), and reviewed by regional organizations and leading experts in FMD control (page 3).

The EMPRES-i genetic module: a new tool for linking epidemiological and genetic influenza information

Combining surveillance, genetic characterization and geomapping for animal influenza viruses can contribute to a better understanding of virus evolution and the epidemiology of influenza. This tool can constitute an influenza gene observatory to support risk assessment of human–animal influenza threats. The EMPRES-i genetic module benefits from existing tools present within EMPRES-i for spatial mapping, export of information, and interfaces with other databases such as the FAO Global Livestock Production and Health Atlas (GLIPHA) and from the phylogenic tools already developed by the Swiss Institute of Bioinformatics (SIB) (page 28).

And...

PERSPECTIVES

FAO develops strategies to curb the economic damage caused by the deadly peste des petits ruminants (PPR)

The Food and Agriculture Organization of the United Nations (FAO) recently organized, in September 2012, two workshops in Addis Ababa, Ethiopia, to work with development partners in East Africa to map out strategies to curb the economic damage caused by the deadly peste des petits ruminants (PPR), also known as "goat plague". The meeting put in motion the first steps necessary to create a regional initiative in the Horn of Africa that would prevent and control the spread of PPR across borders.

A goat showing discharges from the nose and eyes in Bandundu Province of DRC

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Small ruminant farming is key to poverty alleviation in areas where sheep and goats play an important role in food security and income generation. Although there is a lack of complete data on PPR's economic impact, in Kenya, for example, direct and indirect losses from PPR were recently estimated at nearly US$12 million per year. The financial damage includes lost income from milk and meat, the cost of disease control measures and lost trade. For the world's 1 billion poor farmers – most in sub-Saharan Africa and Asia – PPR is devastating and a direct cause of persistent poverty.

PPR is extremely virulent and is particularly devastating for vulnerable smallholder farming families. PPR can have mortality rates of more than 80 percent, killing the few animals a family depends on for their basic food needs and daily income from milk and meat. Already present across a wide swathe of Asia, the Near East and Africa, the virus continues to spread to new countries and threatens an increasing number of livestock keepers and small ruminant populations.

Attendees of the first workshop included chief veterinary officers of several Intergovernmental Authority on Development (IGAD) member countries from the Horn of Africa, representatives from the African Union – Interafrican Bureau for Animal Resources (AU-IBAR) and the IGAD Centre for Pastoralism and Livestock Development and delegates from the World Organisation for Animal Health (OIE) and other international organizations. FAO livestock and animal health officers from various countries and experts from the joint FAO/International Atomic Energy Agency (IAEA) joint programme on nuclear techniques in food and agriculture were also present. FAO worked with participants to:

- ensure a common understanding among experts based in East Africa of the epidemiological situation related to PPR, the socio-economic impact of diseases affecting small ruminants and the development of new control tools;
- broker agreement on the methodology and key elements for the development of a subregional strategy in the Horn of Africa to be aligned with the global, regional and subregional mandates;

- identify and agree on mechanisms for regional coordination of partnerships for the control of PPR and other small ruminant diseases;
- identify the main knowledge gaps related to the implementation of the strategy.

The meeting was organized under the auspices of the European Union-funded Supporting the Horn of Africa's Resilience (SHARE) initiative, which committed €11.5 million for regional interventions, including for animal health programmes. SHARE represents a unique opportunity for assisting countries in implementing, in a coordinated manner, the PPR strategy that has been developed for the Horn of Africa. Participants in a second internal FAO workshop worked together to develop a follow-up roadmap for the joint PPR strategy, a resource mobilization plan and a communication plan to combat the disease. Attendees committed to an aggressive framework of collaboration in order to produce a consolidated FAO position paper on PPR by the end of October 2012, regional/subregional strategies by the end of 2012 and a global strategic framework by mid-2013, which will all be done in collaboration with OIE as FAO's partner in the Global Framework for the Progressive Control of Transboundary Animal Diseases (GF-TADs).Partners agreed the strategy should be developed using a results-based approach, adhere to the Country Programming Framework and be integrated within a regional strategy. Workshop attendees also concluded that FAO should urgently raise awareness of PPR and its enormous impacts on livelihoods and food security.

Towards the Global Control of Foot-and-Mouth Disease (FMD): FAO/OIE – join forces to launch a global initiative on FMD

Outcome of the Global Conference on Foot-and-Mouth Disease Control, Bangkok, Thailand, 27 to 29 June 2012

The second Food and Agriculture Organization of the United Nations/World Organisation for Animal Health (FAO/OIE) Global Conference on Foot-and-Mouth Disease Control took place in Bangkok, Thailand from 27 to 29 June 2012. It was organized by FAO and OIE together with the Thai Ministry of Agriculture and Cooperatives, and supported by several sponsors. Nearly 600 participants from more than 100 countries participated, including FAO regional and national delegates, OIE representatives, government ministers and high-level officials of veterinary services, national delegates, other stakeholders, and representatives of other partner international organizations, major global donors and non-governmental and livestock organizations.

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Second FAO/OIE Global Conference on Foot-and-Mouth Disease Control, Bangkok, Thailand

The conference aims were to present the global status of foot-and-mouth disease (FMD) in its endemic setting and stimulate global efforts to enforce and harmonize control of the disease. A global strategy for FMD control was jointly prepared by the FAO/OIE FMD working group appointed under the umbrella of

the Global Framework for the Progressive Control of Transboundary Animal Diseases (GF-TADs), and reviewed by regional organizations and leading experts in FMD control. The strategy highlights three important components: improving global FMD control, strengthening veterinary services, and improving the prevention and control of other major diseases of livestock. Its main goals are to safeguard food security, alleviate poverty, improve the livelihoods of small livestock holders in FMD-endemic countries, and protect FMD-free countries from incursions of the disease. The budget for the first five years of the global strategy was prepared by the World Bank, in consultation with the FAO/OIE FMD working group. The projected total cost is US$820 million, of which US$762 million (93 percent) is allocated to the country level, US$47 million (6 percent) to the regional level, and US$11 million (1 percent) to the global level. The US$694 million cost of vaccination is by far the largest component of the total costs of implementing the strategy.

Throughout the conference, leading experts gave presentations and reviews describing the impacts of FMD, control activities, state-of-the-art science, and components and tools of the global FMD control strategy. At the end of the conference, donors and representatives from FMD-free and FMD-affected countries presented their views and endorsed the global strategy, highlighting their ongoing contributions to keeping FMD in check.

Conference participants endorsed 38 recommendations addressed to countries, regional and global technical partners, OIE and FAO (through GF-TADs), and development partners.

The third Global Conference on Foot-and-Mouth Disease Control will be held in Africa at a date and venue to be confirmed.

Contributor: Samia Metwally (FAO)

A stepwise approach for progressive control of brucellosis in animals and humans

Introduction

Brucellosis is a contagious disease of mainly ruminant livestock and wildlife that has significant consequences for animal and public health and international trade. The infection is caused by bacteria of the genus *Brucella* represented by at least ten species, among which three – *B. abortus*, *B. melitensis* and *B. suis* – pose serious problems in livestock, humans and sometimes wildlife. In livestock, the major manifestations of infection are abortion, stillbirths and the birth of weak offspring. Many infected animals remain asymptomatic but may shed the organism.

Brucella spp. are found throughout the world. *B. abortus* is found worldwide in cattle-raising regions, except in countries where it has been eradicated; *B. melitensis* is particularly common in the Mediterranean, the Near East, Central Asia and some countries of Central America.

Brucellosis is maintained in the animal reservoir but can cross over to humans as a result of risk factors and behavioural traits. Brucellosis is transmitted to humans from

direct contact with livestock, particularly contact with birth fluids and tissues, or ingestion of unpasteurized milk or milk products. However, brucellosis is not transmitted from humans to livestock. Elimination of the disease in humans is therefore possible only through interventions that vigorously target animal reservoirs.

Despite advances in surveillance and control, the prevalence of brucellosis is increasing in many developing countries because of sanitary, socio-economic and political factors. Many countries in post-communist transition face a sharp increase in zoonotic diseases resulting from the breakdown of government-run disease surveillance and control and weak private health and veterinary services. Fast-growing demand for milk, the subsequent upsurge in peri-urban dairy production, and a lack of adequate food safety practices have been identified as risk factors for human brucellosis in many developing countries.

With varying degrees of success, most countries have attempted to combat brucellosis, leading to changes in its global distribution over time. At present, a number of developed countries (such as Australia, Canada, Japan, New Zealand and countries in northern and central Europe) have eradicated or significantly reduced the prevalence of *B. abortus* infections. However, with the exception of some in Western Europe, few countries have successfully eradicated *B. melitensis* infections, which tend to be associated with more severe human disease than does *B. abortus*.

Control programmes are planned or ongoing throughout the world, adopting different approaches and targeting different priorities. In some developing countries, however, the implementation of these control programmes is not always based on an epidemiologically sound strategy, and the programmes are not planned and sustained for a sufficiently long term to achieve their initial objectives.

To assist member countries in launching, correcting and pursuing brucellosis control programmes aimed at controlling and eradicating brucellosis in animals and humans, the Food and Agriculture Organization of the United Nations (FAO) has designed a roadmap for stepwise progressive control. The roadmap describes a sequence of activities that reduce brucellosis in livestock and humans, eventually leading to the self-declaration of brucellosis-free status as defined by the World Organisation for Animal Health (OIE) Terrestrial Animal Health Code.

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After vaccination against brucellosis, a farmer lets his herd of sheep and goats out to graze, Tajikistan

A stepwise approach for progressive control

The roadmap for progressive control of brucellosis consists of four *stages* (Box 1), each with key activities and objectives; external influences that affect achievement of the desired outcomes of each stage are also identified.

The roadmap is designed to make brucellosis control a progressive process; each country enters this pathway at the stage that corresponds to its prevailing situation. The roadmap guides countries in decisions regarding whether or not to commence or improve their brucellosis surveillance and control programmes.

Box 1: A four-stage roadmap for progressive control of brucellosis in animals and humans

Stage 0: Unknown situation

Situation: Brucellosis in humans and livestock is suspected to occur more or less frequently, but cases/outbreaks are seldom confirmed and prevalence and distribution have not been determined. Veterinary and medical authorities need to know the *Brucella* species involved in suspected cases/outbreaks, the prevalence of the disease in various livestock species, the prevalence in various livestock management systems or zones, and information on how new cases/outbreaks occur, how the disease is spread and how it persists.

Expected outcome: Better understanding of the magnitude of brucellosis infection and an agreed control strategy based on sound epidemiological knowledge.

Stage 1: Known situation with control programme

Situation: The veterinary authority is implementing the agreed national brucellosis control programme either in a pilot area or country-wide. Quality control of vaccines and vaccination delivery by field staff, and laboratory diagnosis have become standard operating procedures. Brucellosis epidemiology units in the public health and veterinary services are collaborating in a national intersectoral brucellosis committee to share information, trace back newly diagnosed human cases and issue public communications.

Expected outcome: Decreased brucellosis prevalence in livestock and humans.

Stage 2: Near to eradication

Situation: Brucellosis sero-prevalence trends are lower in livestock but progress among livestock management systems and districts/zones is uneven. Human incidence is also trending lower. Effective routine surveillance is critical during this stage.

Expected outcome: Brucellosis rates continuing to fall to low levels in livestock and humans.

Stage 3: Self-declared freedom from brucellosis

Situation: The national veterinary authority may make a self-declaration of freedom from brucellosis by meeting OIE standards. Requirements for self-declared freedom from brucellosis change over time, so periodic consultation of OIE standards is necessary.

Expected outcome: Self-declaration of freedom from brucellosis made by veterinary authorities according to OIE standards.

When implementing activities within each stage of the roadmap, veterinary authorities must ensure effective surveillance and monitoring of the quality of inputs, the effectiveness of the work carried out, and progress along the control pathway. Good collaboration between public health and veterinary authorities is another necessary component for effective and documented control of brucellosis in both humans and animals.

The four stages of the roadmap are carefully crafted to allow national veterinary authorities to identify the stage that corresponds to conditions in each livestock system in a particular zone or across the whole country. Veterinary authorities can then enter the most appropriate stage for each situation. A time frame for brucellosis control – which is likely to take at least ten years – should be established, to sensitize policy-makers to the need for realistic expectations and patience in achieving them. However, it should be noted that there is no set time frame for moving from one stage of the roadmap to another. This is because in any country, region or zone, several livestock systems coexist, and different systems are likely to be at different stages of the control pathway, so will require different strategies. Progress over time therefore varies among livestock systems and among the different regions or zones within a single country. Progress in reducing brucellosis prevalence is normally fastest in confined livestock systems and proceeds at different paces for extensive and smallholder systems. For instance, brucellosis control in confined dairy production systems may be at stage 2 or 3, so starting at stage 0 would be a step backwards, while progress in brucellosis control in another livestock system – such as an extensive pastoral system – may fall under stage 0 criteria.

Country control programmes evolve as brucellosis prevalence declines in various livestock management systems. Countries where the brucellosis situation is unknown start from stage 0; those that have already eradicated *B. melitensis* and *B. abortus* infections go straight to stage 3, where measures to maintain freedom status and avoid disease reintroduction are described. However, a country at stage 3 with respect to *B. abortus* and *B. melitensis* may have to step back to a less advanced stage to handle *B. suis* infection encountered in livestock and possibly stemming from wildlife suidae. Such jumping among stages to fit the various brucellosis control situations in different livestock systems or zones, while adapting strategies to epidemiologically prevailing *Brucella* spp. is a unique feature of the roadmap.

Portrait of a woman who once contracted brucellosis (right) from drinking milk, Tajikistan

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The roadmap guides national veterinary authorities in decision-making and planning in epidemiological situations where they face potential infections with various *Brucella* spp. in domestic animals or wildlife. These situations include complex field conditions where both small and large ruminants – such as camels, water buffalo and swine – are raised together in smallholder households or villages and where several livestock species can be infected simultaneously by different *Brucella* spp. The roles of specific *Brucella* spp. in causing infection may not be known initially.

A source of up-to-date information on brucellosis control

As well as descriptions of the four stages of progressive brucellosis control, the roadmap also provides basic information on control tools and strategies, such as a review of control options, recent practical experiences, accepted international opinions, lessons learned from the field, and innovations from research. Links to technical tools (tool kits) and supporting literature or accepted international opinion give national veterinary authorities additional confidence in undertaking roadmap activities. Major issues are discussed, and the text clearly stipulates instances where information is lacking or data are controversial or contradictory.

Factors influencing implementation of the roadmap

Externalities and enabling factors that might influence the course of progressive brucellosis control are highlighted in the roadmap text. Examples of externalities and the prerequisites for implementing a control option provide national authorities with insights into essential management considerations and recognized best practices. These examples enrich the often apparently simple activities recommended, and provide examples of the magnitude of risks, which can allay fears about the use of certain vaccines, for instance. They emphasize the importance of components such as competent field and laboratory services, enabling legislation, effective animal movement control and a compensation system for test-and-removal of animals, in achieving the goal of self-declaration of brucellosis-freedom under OIE standards.

Conclusion

The stepwise approach is being promoted for the progressive control of major transboundary animal diseases and zoonoses, particularly where control or eradication is deemed to be a global public good or where the disease restrains trade in livestock and livestock products. The roadmap for brucellosis control and elimination is designed to provide easy access to clear information for chief veterinary officers and inspectors and their staff responsible for the control of infectious diseases.

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PROGRESS

Controlling transboundary animal diseases in Central Asian countries

Italy funded a project (GTFS/INT/907/ITA) for eight years, from August 2004 to July 2012. The beneficiaries were five Central Asian countries – Afghanistan, Pakistan, the Republic of Tajikistan, Turkmenistan and the Republic of Uzbekistan – and the project was conducted in three phases. The overall focus was on institutional capacity building to assist the veterinary services of beneficiary countries in designing and implementing control activities for transboundary animal diseases (TADs). The four specific objectives were to:

1. progress towards verification of freedom from rinderpest, enabling countries to enter the World Organisation for Animal Health's (OIE's) Pathway to Rinderpest Freedom;
2. improve understanding of the impacts of peste des petits ruminants (PPR), foot-and-mouth disease (FMD) and other major livestock diseases in the countries;
3. establish communication for collaborative disease control among the countries;
4. establish national disease investigation, control and contingency planning for TADs.

This institutional capacity building project aimed to assist the veterinary services of beneficiary countries in designing and implementing control activities for TADs. Senior national veterinary staff attended international meetings and were exposed to new TAD control strategies. Project design was based on the paradigm that TAD control requires a regional approach because the efforts of individual countries may not succeed if neighbouring countries do not adopt also control activities. The project offered the five beneficiary countries plus the Islamic Republic of Iran and Kazakhstan opportunities for meeting and discussing their respective situations, challenges and constraints, thus encouraging a regional approach.

Main achievements

The project started on 2 August 2004 under the Trust Fund for Food Safety and Food Security – Italian Contribution. It was initially planned to terminate on 31 December 2007 (phase I), but was extended first until 31 August 2010 (phase II) and then until 31 July 2012 (phase III).

Main outcomes of phase I (August 2004 to December 2007)

Implementation of project activities was delayed pending endorsement of the project document by Uzbekistan and Turkmenistan and by the volatile security situation in Afghanistan, but important objectives were achieved during this phase:

- *Recognition of freedom from rinderpest:* All project countries were assisted in carrying out field activities and formulating dossiers to be submitted to OIE for official recognition of freedom from rinderpest. During the OIE General Session in May 2008, Afghanistan, Tajikistan and Uzbekistan were declared and certified free from rinderpest. Pakistan had obtained such recognition in 2007; the dossier submitted by Turkmenistan in 2008 was accepted in 2010.

- *Strengthened disease epidemiologic surveillance abilities of national veterinary services:* The achievement of rinderpest freedom required a great deal of support to ensure that the overall surveillance system could provide reliable information on disease absence. In addition to laboratory support, the project provided training for 2 202 field veterinarians, who improved their clinical abilities in recognizing major TADs (rinderpest, FMD and PPR), and 8 336 farmers, who were reached through the participatory disease surveillance (PDS) approach in 571 villages. The process for ensuring that project countries were free from rinderpest was based on: i) field veterinarians acting as sentinels of the health status of susceptible populations; ii) farmers providing information on their livestock's health status; and iii) sample collection and testing – 12 000 blood samples were collected and tested in each country.
- *Strengthened diagnostic capacity:* The project provided central veterinary laboratories with equipment, supplies, diagnostic kits and training for local staff, enabling them to implement the two prescribed rounds of sero-surveillance to prove the absence of rinderpest from the cattle and buffalo populations of their respective areas. Project support also enabled beneficiary countries to establish diagnostic protocols for other major TADs, such as FMD and PPR.
- *Improved technical-institutional relationships:* By sharing goals and adopting a common vision on surveillance and control strategies, neighbouring countries greatly enhanced their trust and confidence in each other. The results of the rinderpest campaign appeared to be more robust when neighbouring countries achieved similar results with the same surveillance approach.

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First regional workshop of GTFS/INT/907/ITA in Dishanbe (Tajikistan) in April 2005

Main outcomes of phase II (January 2008 to August 2010)

Once rinderpest was no longer an issue in the region, the project focused on diseases known to be present – such as FMD and PPR – for which field activities had to be redesigned within the framework of a progressive control and stepwise approach.

The project collaborated with the European Commission for the Control of Foot-and-Mouth Disease (EUFMD) based at FAO Headquarters in Rome to design a regional progressive control pathway (PCP) for FMD in the West Eurasia region (which includes the five project beneficiary countries).

In 2010, OIE endorsed this approach as one of the tools under the Global Framework for the Progressive Control of Transboundary Animal Diseases (GF-TADs), a joint FAO/OIE initiative. The PCP-FMD is based on indicators of country progress in risk identification and management along a progressive control pathway of five stages, enabling countries to recognize which stage they are at and which activities are a priority for moving forwards to the next stage. This progressive approach was formalized in late 2010 through an expert consultation meeting held at the Pirbright Institute in the United Kingdom of Great Britain and Northern Ireland:

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Epidemiology training in the FAO subregional office in Ankara, Turkey.

- *Progressive approach:* Surveillance programmes collected samples from various animal husbandry systems – household, commercial, transhumant, etc. Much of the work and many of the approaches adopted were generated from experience gained in Pakistan, where field activities clearly identified that a particular animal husbandry system – known as "dairy colonies", which are present only in Pakistan around large cities such as Karachi, Lahore and Islamabad – is a natural reservoir of FMD. The preliminary results of these activities were discussed at the Project Technical Meeting held in Ankara, Turkey in June 2009, and the final results were presented at the Project Tripartite Regional Meeting held in Istanbul, Turkey in October 2009, concurrently with the second meeting for the West Eurasia Roadmap.
- *Training component:* The project countries needed to upgrade their diagnostic protocols and introduce novel tests. Letters of agreement were signed with the *Istituto Zooprofilattico Sperimentale della Lombardia e dell'Emilia Romagna* (IZSLER), Brescia, Italy, to provide project countries with training and supplies of reagents.

Main outcomes of phase III (September 2010 to July 2012)

The main objectives of this phase were to consolidate the work carried out previously so that each country could self-sustain field activities with limited resources (basically by procuring diagnostic kits). Diagnostic capability was consolidated and the project assisted by developing capacities in designing TAD control and implement monitoring and surveillance systems.

Conclusions

Some of the project's original expectations and the individual country situations outlined in the project document may have underestimated the challenges faced. An important issue was the long time required for some countries – Turkmenistan and Uzbekistan – to endorse the project document, which resulted in intermittent implementation of project activities. It is also likely that at the initial stage of project design, the sensitivity of some TADs (such as FMD) was overlooked. Efforts to overcome these issues as they emerged during project implementation included gathering information, providing evidence and proposing possible solutions.

The control of TADs is a major challenge for any veterinary service. However, once the capability and capacity to address a complex disease such as FMD has been attained, sound control strategies for other major livestock diseases can often be developed by adapting the framework of these existing programmes and capacities. It is therefore highly recommended that countries assisted by the project continue their policy of *transparency* on TADs and fulfil the requirements of reporting to the international community through OIE's official channels.

The project contributed significantly to the formulation and development of a framework for progressive disease control (the PCP-FMD) that enables countries progressively

to reduce the load of disease in their animal populations. All countries assisted by the project are currently in stage 1 of the PCP-FMD, and it is important that these countries continue their efforts in applying PCP-FMD principles and adopt a similar approach for other diseases of concern, especially PPR.

Application of PCP-FMD principles for other diseases (such as PPR) may require an initial minor investment. However, through the information generated by project activities, all beneficiary countries already have sufficient elements to start targeted control programmes. These are likely to be carried out with the implementation of pilot vaccination campaigns in selected geographical areas or small ruminant husbandry systems. Some project countries have already been exposed to such programmes. For example, Tajikistan has been assisted in identifying PPR for the first time in its territory. The occurrence of this disease led to the formulation of a Technical Cooperation Programme (TCP) project (TCP/TAJ/3002) in which one of the major components was a vaccination programme.

The following publications provide further examples of the project's technical achievements.

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The Scientific Task Force on Wildlife and Ecosystem Health: promoting One Health across sectors

One of the greatest challenges of the twenty-first century is meeting the competing demands of global food security and sustainable natural resource management, given the trends in human demographics worldwide. Across the globe, communities under stress use various methods of coping with food insecurity, including expanding livestock farming, increasing the use of forest-derived species as a source of food, and expanding the wildlife farming sector.

To date, a balanced approach has not been identified, resulting in unhealthy ecological and agricultural systems in various areas worldwide. Within the context of global food insecurity and global environmental change, an additional challenge is the emergence and re-emergence of diseases. Around 60 percent of recent emerging infectious diseases in humans are zoonotic, of which 70 percent originate in a wide range of wildlife populations. These pathogens include the human immunodeficiency virus (HIV), the severe acute respiratory syndrome (SARS) virus, H5N1 highly pathogenic avian influenza (HPAI) virus, and bat-derived henipaviruses (FAO, 2011).

It has become clear that the emergence of pathogens is a highly complex process, which can often be traced back to ecosystem changes associated with one or more factors such as an expanding human population, food insecurity and unsustainable use of natural resources. These ecosystem changes can also decrease the availability of ecosystem services

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Group picture of the participants of the launching workshop of the Scientific Task Force on Wildlife Diseases and Migratory Species

such as purification of air and water, delivery of food for humans and animals, and provision of biological resources for scientific research. Decreased availability of ecosystem services has a negative impact on the health of all species, including plants, wildlife, livestock and humans. In parallel to these local-level influences, there is also need to monitor climate-associated changes in ecosystem dynamics, which can cause wildlife to alter habitat use and migration patterns; pathogens to increase in prevalence, diversity and range; and resource availability to decline.

Recent experiences with influenza viruses serve to illustrate the important links among human, livestock and wildlife health. The emergence of H5N1 HPAI had broad impacts on all three health sectors, resulting in serious conservation concerns for threatened species such as the bar-headed goose (*Anser indicus*), and prolonged outbreaks that affected health, livelihoods and food security for millions of people, and international trade. The 2009 H1N1 pandemic caused by a virus containing gene segments from humans, pigs and birds highlighted the dangers associated with virus transmission among humans, livestock and wildlife, in this case resulting in a pandemic threat that – fortunately – had low pathogenicity for humans. These two influenza pandemics affected both animals and humans, spread rapidly, affected global economies and continue to require a coordinated and collaborative international response for monitoring, outbreak response and control. They therefore illustrate aspects of the need for a One Health approach to emerging infectious diseases.

In Kazakhstan, during 2010 thousands of the endangered Saiga antelope (*Saiga tatarica*) succumbed to an unknown disease within the span of one week, resulting in the loss of more than half of the local population. Over the past decade, these migrating ruminants have been threatened by poaching, decreased rangeland and multiple disease outbreaks. Through fieldwork led by the World Wildlife Fund and the United Nations Environment Programme Convention on Migratory Species (UNEP-CMS), with contributions from the Food and Agriculture Organization of the United Nations (FAO) and many other organizations, the most likely cause of death was determined to be pasteurellosis, which can also cause pneumonia in local livestock species. In this case the causative agent had potential to move from livestock to wildlife, or the reverse, or to cycle in both directions. Again, a multidisciplinary approach will be necessary to resolve the disease and maintain the wildlife population in this environment.

Not all food harvesting from the environment has a detrimental effect, but it is clear that in some locations food security and cultural preferences exert significant pressure on declining forest-based wildlife populations. While hunting and consumption of local forest resources may be sustainable, the lucrative business of hunting wild meat and exporting it to expatriate migrant groups in global urban centres has resulted in unsustainable depletion of wildlife. Wildlife conservationists advocate the preservation of wildlife species, while organizations concerned with food security advocate the sustainable use of natural

resources as a source of livelihoods. In areas where people rely directly on the use of natural resources it is imperative that these two groups are able to work together to find solutions that take into account the human concerns as well as the environmental and conservation-related issues. In these and other issues, researchers, public health professionals, policy-makers and natural resource managers must work together to come up with multidisciplinary solutions that encompass food security, livelihoods, poverty reduction and biodiversity conservation through a One Health approach.

Building on experience of the successful Scientific Task Force on Avian Influenza and Wild Birds, the Conference of the Parties to UNEP-CMS passed Resolution 9.8 (in Rome, Italy in 2008) which calls on UNEP-CMS and FAO's Animal Health Service to co-convene the Scientific Task Force on Wildlife Diseases – now known as the Scientific Task Force on Wildlife and Ecosystem Health – with the aim of identifying diseases that have a negative impact on both captive and migratory wildlife and that are of greatest concern with regard to food security, sustainable livelihoods and biodiversity conservation. At a workshop in Beijing, China in June 2011, technical priority areas were identified, including a broad range of working areas that expand the original mandate of the task force to focus on a One Health approach.

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Participants in the capacity development workshop learning about the important role bats play in the ecosystem interface, Bangladesh, September 2012

The main working areas of the task force are:

1. *wild birds and avian influenza,* continuing the work of the FAO and UNEP-CMS co-convened Scientific Task Force on Avian Influenza and Wild Birds,[1] sharing information as needed;
2. *migration ecology,* reaching out to the international scientific community studying animal movements and migration to improve the identification of important conservation areas and increase the understanding of disease ecology and risk modelling;
3. *disease ecology,* working with international partners to develop wildlife-focused communication and training materials regarding the spread, control and prevention of diseases affecting wildlife populations;
4. *wildlife morbidity and mortality event tracking,* encouraging natural resource professionals and wildlife biologists to record both disease- and, especially, non-disease-related wildlife morbidity and mortality events to improve understanding of the factors that affect the vigour of wildlife populations;
5. *the human–wildlife–livestock–ecosystem interface,* including trans-frontier conservation areas, wild meat harvesting and captive farmed wildlife, looking specifically at the issues that occur at this interface;
6. *bridging the gap between natural resource professionals and health professionals,* to improve communication between professionals in both sectors by providing concise science-based information that can be shared across sectors, while encouraging multidisciplinary work.

[1] www.aiweb.info

In November 2011, UNEP-CMS held the Tenth Conference of the Parties in Bergen, Norway, where Resolution 10.22 Wildlife Diseases was passed. This resolution requests the task force to create materials for dissemination through the Parties, facilitate workshops to increase collaboration, and liaise with other international groups working on wildlife disease issues, including wildlife disease surveillance, food security concerns, interactions between disease and wildlife or ecosystem health, and outbreak control.

The Scientific Task Force on Wildlife and Ecosystem Health[2] now includes more than 15 bodies ranging from multilateral environmental agreements, to professional associations and student groups, and representing a global perspective. The task force works to achieve better health for ecosystems, wildlife, livestock and people by promoting an integrated scientific approach to problems within a One Health framework. The task force publishes a bimonthly newsletter covering new developments in the field of wildlife and ecosystem health, maintains a Web site of up-to-date information, and encourages participation and information sharing through presence at many international meetings. Other outputs of the task force include disease fact sheets, case studies of diseases affecting wildlife, fact sheets on livestock and human populations, fact sheets on ecosystem services and biodiversity, technical papers, and Web-based learning tools. The task force facilitates coordination, information sharing, communication and understanding among relevant organizations, networks, administrations and professional disciplines. Through international collaboration, the Scientific Task Force on Wildlife and Ecosystem Health will help improve the well-being of humans, livestock, wildlife and the ecosystems in which they live.

More information from:

FAO: www.fao.org
UNEP-CMS: www.cms.int/
Contact us: wildlifeandecosystemhealth@gmail.com

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[2] www.wildlifeandecosystemhealth.org

FAO supports regional animal health networks

1. Laboratory networks in Africa and Asia

A collaborative initiative to improve regional resource laboratories in a sustainable manner

For many years, the Food and Agriculture Organization of the United Nations' (FAO's) support to veterinary laboratories and laboratory networks has contributed to major achievements such as eradication of rinderpest and earlier diagnosis for the control of other animal diseases, including zoonoses and emerging diseases. FAO has supported the establishment of several regional laboratory networks (RLNs) and provides ongoing coordination and support. The sustainability of such networks is dramatically improved through recognition and support from national governments and linkages to regional economic organizations or other governance bodies. Under these regional frameworks, each network agrees on strategic approaches for strengthening diagnostic and investigation capacities, mapping regional gaps and resources through laboratory assessments, sharing information and biologic material, and improving linkages between human and animal health. Resource laboratories, known as "support" or "leading diagnostic" laboratories in sub-Saharan Africa and Southeast Asia, are identified and assigned regional responsibilities such as provision of services for disease confirmation, production of standardized reagents and harmonized protocols, and capacity building.

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In sub-Saharan Africa, five regional support laboratories (RSLs) representing national animal health laboratories in Botswana (Botswana National Veterinary Laboratory [BNVL]), Ethiopia (National Animal Health Diagnostic and Investigation Centre [NAHDIC]), Nigeria (National Veterinary Research Institute [NVRI]), Senegal (*Laboratoire National d'Elevage et de Recherches Vétérinaires* [LNERV]) and South Africa (Agricultural Research Council Onderstepoort Veterinary Institute [ARC-OVI]), were selected to provide technical services and capacity building for other national laboratories within the region. The specific roles and responsibilities of these five RSLs were discussed and agreed during a meeting, sponsored by the USAID-funded IDENTITY project, conducted by FAO in July 2012 in Addis Ababa, Ethiopia and attended by representatives of the five RSLs, the African Union's Interafrican Bureau for Animal Resources (AU-IBAR) and Pan African Veterinary Vaccine Centre (AU-PANVAC), the World Organisation for Animal Health (OIE), the International Atomic Energy Agency (IAEA), the International Cooperation Centre of Agricultural Research for Development (CIRAD), the *Istituto Zooprofilattico Sperimentale delle Venezie* (IZSVe), the Central Veterinary Research Laboratory (CVRL) and the three RLNs – the Eastern African Region Laboratory Network (EARLN), the Southern African Development Community's (SADC's) LABNET, and the West and Central Africa Veterinary Labora-

tory Network for Avian Influenza and other Transboundary Diseases (RESOLAB). The meeting agreed that the role of the RSLs is "to assist the National Laboratories within the region to build/enhance capacity in the diagnosis of animal diseases including zoonoses" (FAO Subregional Office for Eastern Africa, 2012).

Towards this end, the RSLs are responsible for strengthening and sustaining their own capacities to fulfil their Terms of Reference. The position of the RSLs regarding the OIE/FAO Reference Centres was also clarified and agreed. The recommendations from the meeting are closely aligned with frameworks already in place in each of the three RLNs and will be taken forward by the respective laboratories and networks. The RSLs noted potential constraints to fulfilling their regional obligations, including inadequate budget, poor quality and low number of samples received by submitting laboratories, shortage of reagents, lack of quality management systems, and high turnover of laboratory management staff.

Participants of the meeting held in July 2012, Addis Ababa, Ethiopia

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FAO is working on the next steps of this process of strengthening the status of RSLs. First, a meeting will be held involving FAO, AU-IBAR and all the regional economic communities in sub-Saharan Africa to present the achievements of preliminary activities and the constraints and opportunities in the RSL initiative, and to explore ways of ensuring institutional, technical and financial continuation and sustainability of the initiative. Thereafter, work plans for the regional economic communities will be prepared, including activities and advocacy and funding mechanisms. To this end, a meeting will be held with the regional economic communities, the RSLs, some national laboratories, representatives of each of the RLNs, technical partners (OIE/FAO Reference Centres) and financial partners.

In Southeast Asia, three regional leading diagnostic laboratories (RLDLs) have been appointed to provide disease-specific services for the region: the OIE Reference Laboratory for Foot-and-Mouth Disease at Thailand's National Institute of Animal Health (NIAH); Regional Animal Health Office No. 6 (RAHO6) in Viet Nam, for classical swine fever; and the Veterinary Research Institute (VRI) in Malaysia, for highly pathogenic avian influenza (HPAI). Under the RLN framework, FAO supports the RLDLs in fulfilling their regional roles and responsibilities, including by strengthening laboratory management and technical expertise. FAO also collaborates with the RLDLs to conduct RLN workshops on diagnosis of priority diseases, thereby leveraging the RLDLs' specific diagnostic expertise. Such activities provide excellent opportunities for the RLDLs to collaborate with internationally recognized trainers, gain experience of organizing regional training, and share their specific expertise with RLN members. These training activities also enhance the visibility of the RLDLs and interactions among network laboratories across the region.

In addition to their contribution to strengthening regional laboratory capacities, the directors of the RLDLs are also involved in the development of RLN strategies and policies, and participate in Regional Laboratory Technical Advisory Group meetings, which provide technical inputs for strategic planning and laboratory capacity building activities. The RLDLs take turns to host a forum for all laboratory directors in the RLN. This regional forum provides a venue for discussing problems and issues related to national veterinary diagnostic laboratories, and serves as a coordinating platform for promoting quality services, collaboration and networking among member laboratories. Recommendations and outcomes from the forum provide the basis for planning and implementation of new activities to strengthen laboratory capacity and quality services in Southeast Asia. One of the major outputs of the forum is the Regional Strategic Framework for Laboratory Capacity Building and Networking in Southeast Asia, which describes the main strategic goals and action plans for promoting the sustainable development of diagnostic capacities, quality laboratory services, and sharing of information and expertise among veterinary diagnostic laboratories. Endorsed by the Association of Southeast Asian Nations (ASEAN) in August 2012, the strategic framework represents significant progress in engaging the regional economic community in supporting the development of quality laboratory services at the policy level.

Meeting on defining the status , roles and responsibilities of regional laboratories in sub-Saharan Africa, July 2012, Addis Ababa, Ethiopia

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FAO's mission is to contribute to economic growth, food security and safety, and animal health through timely early warning and disease intelligence based on the sharing of reliable, consistent and transparent information. National animal health laboratories responsible for disease detection and surveillance are central to this mission. Building technical capacity, competency, leadership and a critical mass of regionally networked epidemiology, surveillance and laboratory specialists is a strategic imperative for the efficient and effective coordination of risk management for transboundary animal diseases and zoonoses, including HPAI.

Reference

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2. Epidemiosurveillance networks in Africa

In response to persistent animal epizootic diseases, lack of harmonization among regional strategies for the monitoring and control of major transboundary animal diseases (TADs), and the need to strengthen national animal disease surveillance systems, the countries of East, Central and West African have established regional networks for epidemio-surveillance and laboratory diagnostics, with support from the Food and Agriculture Organization of the United Nations (FAO) and partners. These are not the first regional networks for animal health in Africa; similar initiatives were developed during implementation of the African Union Interafrican Bureau for Animal Resources' (AU-IBAR's) continental programmes for eradicating rinderpest – the Pan-African Rinderpest Campaign (PARC) and the Pan African Campaign for the Control of Epizootics (PACE). However, although these earlier networks were considered critical to the success of PARC and PACE, they were not sustained when the projects ended.

A Regional Network of National Epidemiosurveillance Systems for Transboundary Animal Diseases (RESEPI) for West Africa was created in December 2008, and was extended to include Central Africa in November 2009. The Eastern Africa Region Epidemiology Network (EAREN) was launched in April 2009.

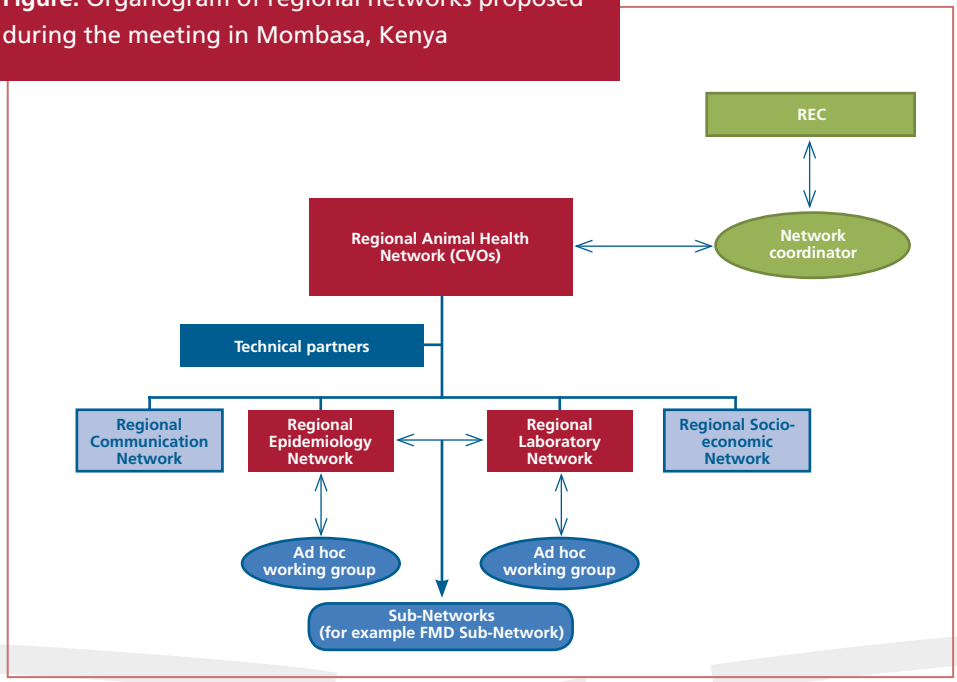
Each network generally organizes an annual meeting with the participation of representatives from each of the countries in the region, representatives of the regional economic community and technical partners. Regional network meetings were held in East and West Africa in July and September 2012, to assess the status of regional networks and national epidemio-surveillance systems, discuss the transboundary animal and zoonotic disease situation, and identify prospects for strengthening epidemio-surveillance in the regions.

Participants of the joint epidemiology and laboratory meeting, July 2012, Mombasa, Kenya

FAO

A joint epidemiology and laboratory annual coordination meeting for East Africa took place in Mombasa, Kenya from 24 to 27 July 2012. The meeting was organized by FAO's Emergency Centre for Transboundary Animal Disease Operations (ECTAD) and co-funded by the IDENTIFY and VET-GOV projects. IDENTIFY is a component of the United States Agency for International Development's (USAID's) five-year Emerging Pandemic Threats (EPT) programme, launched in October 2009 and jointly implemented by FAO, the World Organisation for Animal Health (OIE) and the World Health Organization (WHO). VET-GOV is funded by the European Union (EU) and jointly implemented by AU-IBAR, OIE and FAO in collaboration with regional economic communities, to reinforce veterinary governance in Africa. The meeting was attended by representatives from 12 countries (Burundi,

Figure: Organogram of regional networks proposed during the meeting in Mombasa, Kenya



the Democratic Republic of the Congo, Djibouti, Eritrea, Ethiopia, Kenya, Rwanda, Somalia, South Sudan, the Sudan, Uganda and the United Republic of Tanzania) and representatives from OIE, AU-IBAR, AU's Pan African Veterinary Vaccine Centre (AU-PANVAC), the International Livestock Research Institute (ILRI), the Intergovernmental Authority on Development (IGAD), the *Istituto Zooprofilattico Sperimentale delle Venezie* (IZSVe) Padova (Italy), the National Veterinary Institute of Sweden (SVA) and the African Field Epidemiology Network (AFENET). As this was a joint epidemiology and laboratory meeting, its objectives included reviewing the status of laboratory and epidemiology networks and the results of veterinary diagnostic laboratory proficiency tests carried out in 2011.

RESEPI's meeting took place in Accra, Ghana from 10 to 13 September 2012 and was jointly organized and funded by FAO, the United States Department of Agriculture's Animal and Health Inspection Service (USDA-APHIS), USAID and Africa Command (AFRICOM). Representatives from 21 West and Central African countries (Benin, Burkina Faso, Cameroon, Cape Verde, Chad, Congo, Côte d'Ivoire, the Democratic Republic of the Congo, Equatorial Guinea, Gabon, the Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, the Niger, Nigeria, Senegal, Sierra Leone and Togo) participated, along with representatives of FAO, AU-IBAR, the Economic Community of West African States (ECOWAS), USDA-APHIS, USAID, AFRICOM and the Southern Africa Development Community (SADC).

Participants at the two meetings agreed on the need to restructure epidemiological networks and consolidate regional animal health networks under a single

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Meeting of the Regional Network of National Epidemiosurveillance Systems for Transboundary Animal Diseases (RESEPI) in Accra, Ghana

sector-wide umbrella. Such restructuring aims to increase the participation of chief veterinary officers (CVOs) and countries in coordinating the regional networks. One of the main recommendations of the Mombasa meeting was to establish a Regional Animal Health Network (RAHN) as the umbrella for all regional animal health-related networks, including those in the areas of epidemiology, laboratory, socio-economics, communications and wildlife. RAHN will be chaired by the CVOs of member countries, on rotation. The Accra meeting agreed to establish two regional epidemiology networks, one for Central Africa and one for West Africa, to be linked to the Economic Community of Central African States (ECCAS) and ECOWAS respectively. Each regional network will have two coordinators appointed by member countries, and each country will appoint a focal point from its epidemiology unit as its representative in the regional epidemiology network.

The networks have strong support from all the countries in the regions. Their value was clearly established during rinderpest eradication programmes, and they are expected to contribute much to enhancing the control of TADs and zoonoses in Africa in the future. However, their ongoing viability – at least in the early days – depends on receiving sufficient support from technical partners and donors.

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IN ACTION

In the field...

Peste des petits ruminants in the Democratic Republic of the Congo: a fast-moving threat for food security in Africa

Peste des petits ruminants (PPR) is a severe, fast-spreading disease of mainly domestic small ruminants, acquired through direct contact between infected and susceptible animals. It is characterized by a sudden onset of depression, fever, discharges from the eyes and nose, erosions in the mouth, disturbed breathing and cough, foul-smelling diarrhoea, and death. The virus that causes PPR (PPRV) is closely related to the rinderpest virus of cattle and buffaloes (now globally eradicated), the measles virus of humans, the distemper virus of dogs and some wild carnivores, and the morbilliviruses found in aquatic mammals.

In March 2012, the Ministry of Agriculture of the Democratic Republic of the Congo (DRC) officially reported unexpected mortality in small ruminants, especially goats, to the World Organisation for Animal Health (OIE). In western Kwilu District, Bandundu Province, more than 10 000 animals in the past month were said to have shown profuse, blackish diarrhoea, fever and weight loss before dying within five to eight days. Different districts of the same province reported the same phenomena, and the Veterinary Laboratory of Kinshasa confirmed the presence of PPR in the affected flocks.

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Movements of infected animals by road transport facilitated rapid spread of the disease and increased the food security impact of PPR in DRC

Faced with this emergency, on 11 April 2012, the Government of DRC requested the Food and Agriculture Organization of the United Nations (FAO) for support in assessing the epidemiological situation and strengthening response capacity. On 22 April 2012, the FAO/OIE Crisis Management Centre – Animal Health (CMC-AH) deployed an international expert team comprising a PPR control specialist and two operational officers, to conduct field investigations.

The main risk factor identified as contributing to the rapid spread of the epidemic was increased movement of animals for trading purposes. Commonly, goats in the affected or at-risk zones are sold along the main roads connecting villages. Once sold, the animals are frequently transported further east by vehicle, thus favouring rapid spread of the disease by movement of infected animals to unaffected areas.

The high socio-economic impact of PPR was apparent to the CMC-AH team while in the field. In affected villages, remaining goats were sold during the emergency for less than their usual market values. This had a direct impact on household revenues and reduced the value of goats for families in the region. The depletion of the goat population of Bandundu Province, caused directly by the disease or through in-

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A CMC-AH expert checking a goat for signs of PPR infection

creased trading to affected or neighbouring villages, endangers food security in the medium to long term. Lack of animals and subsequent increases in market prices will limit access to a precious source of animal protein for most of the people living in this area.

In collaboration with the FAO representation in DRC and the Ministry of Agriculture, the team of international experts used its findings from field investigations to propose an emergency Technical Cooperation Programme for supporting – among other actions – a vaccination campaign to protect flocks further east in the province, to slow the spread of the disease. The US$415 000 proposal was accepted, enabling the vaccination campaign to be officially launched on 25 August 2012. By 13 September 2012, 20 vaccinators and five supervisors had been trained and equipped, and about 177 000 animals had been vaccinated.

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Training

EMPRES-i in Asia

In September 2012, two training workshops on the Global Animal Disease Information System (EMPRES-i) were held in Thailand and China. The aims of the workshops were to: i) introduce the EMPRES-i and EMPRES-i Asia platforms and available tools; ii) provide practical exposure to both platforms; iii) obtain feedback on the utility of the system, to improve the use of EMPRES-i by national-level veterinarians; and iv) introduce basic risk assessment concepts and outline how the data available within EMPRES-i and various Food and Agriculture Organization of the United Nations (FAO) Web sites – including the Global Livestock Production and Health Atlas (GLIPHA) and the Corporate Database for Substantive Statistical Data (FAOSTAT) – could be used to inform rapid risk assessment.

The training in Bangkok, Thailand took place over three days (11 to 13 September) and was attended by 25 participants from two FAO regional offices – the Regional Support Unit (RSU) for South Asian Association for Regional Cooperation (SAARC) countries, and the Regional Office for Asia and the Pacific (RAP); four FAO Emergency Centre for Transboundary Animal Disease Operations (ECTAD) country teams – Bangladesh, Cambodia, Indonesia and Viet Nam; and nationals from ten country governments – Bangladesh, Bhutan, Cambodia, Indonesia, Lao People's Democratic Republic, Maldives, Myanmar, the Philippines, Thailand and Viet Nam.

The training in Qingdao, China lasted for two days (17 to 18 September) and was attended by 22 participants from the China Animal Health and Epidemiology Center (CAHEC) and the China Animal Disease Control Center (CADC).

Both workshops included a series of lectures and practical exercises so participants could become familiar with the two system platforms. The workshops were facilitated by Caryl Lockhart, Veterinary Epidemiologist in the FAO Global Early Warn-

ing and Response System for Major Animal Diseases, including Zoonoses (GLEWS) team, with assistance from Dr Tum Sothyra, from FAO RAP in Bangkok, and Ms Zhou Xiaoyan, Geographic Information System (GIS) specialist from the FAO ECTAD office in China.

An outcome of the workshops is the recommendation to conduct future training in spatial analysis and modelling and in social network analysis (SNA). Both workshops were partially funded under the Australian Department of Agriculture, Fisheries and Forestry (DAFF) project DAFF OSRO/GLO/102/AUL.

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Participants of the training on ***the Global Animal Disease Information System (EMPRES-i)***

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The principles of molecular epidemiology: workshop in Nairobi, Kenya

Advanced characterization of pathogens through genome sequencing can help the collection of important information on the genetic origin of these pathogens, and the identification of genetic reassortment events or mutations and their biological properties such as antiviral or antimicrobial resistance. Molecular epidemiology takes sequence data into account and uses them for epidemiological analysis, thereby gaining a deeper understanding of patterns of diseases, including disease origin, extent of spread, disease reservoirs and genetic similarities or dissimilarities among circulating strains. Broadening epidemiological analysis to include such data will help countries to adapt and improve disease management programmes and interventions. In addition, genome sequencing of pathogens supports diagnosis of diseases, especially in settings where other techniques, such as virus isolation, are not available.

Assessment of laboratory capacities based on the Food and Agriculture Organization of the Untied Nations' (FAO's) Laboratory Mapping Tool (FAO, 2012) and carried out in nine IDENTIFY[3] countries in the Congo Basin revealed that sequencing technology is not available in any of these countries. Laboratories often store sample aliquots but seldom submit them to international laboratories for sequencing. Useful information on the pathogens and their epidemiologic patterns is therefore lost. In response, the Genetic Sequencing Services (GSS) initiative was created, with the aim of improving countries' access to genetic sequencing services.

The GSS initiative, implemented under the IDENTIFY project, started with a four-day workshop for epidemiologists from national epidemiology units, and quality control managers working in vaccine manufacturing laboratories. The workshop was held by FAO from 25 to 28 September 2012 in Nairobi, Kenya, in collaboration with the International Cooperation Centre of Agricultural Research for Development (CIRAD), and comprised both theoretical and practical sessions. The aim of the workshop was

[3] IDENTIFY is a project funded by the United States Agency for International Development (USAID) under the Emerging Pandemic Threats (EPT) programme (FAO, 2012: 24).

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Participants of the workshop on the principles of molecular epidemiology, Nairobi, Kenya

to make participants aware of different applications for using sequencing information in their work. Participants included nationals from Botswana, Cameroon, Democratic Republic of the Congo, Ethiopia, Kenya, Nigeria, Senegal, Uganda and the United Republic of Tanzania, and representatives from the FAO Emergency Centre for Transboundary Animal Disease Operations (ECTAD) Unit for Eastern Africa, the African Union's Pan African Veterinary Vaccine Centre (AU-PANVAC), the Kenya Veterinary Vaccines Production Institute (KEVEVAPI), the Botswana Vaccine Institute (BVI) and the Nigerian National Veterinary Research Institute (NVRI).

The first two days served to provide an overview of the different methods used for molecular characterization of pathogens, the types of data that can be generated, and how these data can be used in epidemiological analysis. Topics included the importance of molecular biology for good vaccine design and vaccine quality. Guided examples illustrated how to apply molecular epidemiology in real-life situations and included sequencing strains for vaccine matching of highly pathogenic avian influenza and contagious bovine pleuropneumonia (CBPP), surveillance of bluetongue and peste des petits ruminants (PPR), and screening for and confirmation of pathogen introductions of Rift Valley fever.

On the third day, two scenario-based training sessions were offered in which participants were required to use their newly acquired skills to investigate real-life problems. The first session was organized as interactive group work and aimed to stimulate participants to think about outbreak investigation, the use of molecular data to handle pathogen emergence, and how to coordinate with biologists to conduct common surveys and other activities in the field. The scenario proposed illustrated the emergence of a new foot-and-mouth disease (FMD) strain in a country that was vaccinating. Phylogenetic trees were used to identify and characterize the emerging strain (which was genetically different from endemic local strains), track the virus within the country (genetic similarities of strains), and examine evidence for a possible vaccine failure. A second scenario focused on monitoring and control of Newcastle disease.

In addition to these thematic sessions, group discussions were held on mechanisms for improving collaboration between epidemiological and laboratory units within countries and at the international level. The main conclusions from the discussions were the need to improve communications between partners, such as through regular joint meetings, jointly planned field visits, national surveillance programmes with clear differentiation of responsibilities between epidemiological and laboratory units, and harmonized protocols and guidelines for joint work and the sharing of essential data (Box 1). On the last day, workshop participants were asked to develop an action plan for implementing the GSS initiative in their respective countries. In this exercise, participants were encouraged to list disease priorities, estimate the number of samples that should be submitted for sequencing, and propose partners for project implementation. Items highlighted in these

Box 1: Recommendations from the Nairobi workshop

Improved communication:

- international networks and meetings;
- international conventions/ guidelines supported by FAO and the AU's Interafrican Bureau for Animal Resources (AU-IBAR);
- regular national meetings;
- regular training of field veterinarians and epidemiologists in sample collection.

Building mutual trust and understanding:

- design of communication strategies and standard operating procedures (SOPs);
- planning ahead: epidemiologists should inform laboratories in advance about samples arriving;
- timely sharing of results;
- SOPs for the sharing of sensitive information.

Joint planning, with clear responsibilities:

- national surveillance programmes;
- joint emergency investigations.

Harmonized protocols and guidelines:

- guidelines on which samples to collect and how to store and send them, organized by disease;*
- protocols for sample collection and submission;
- a harmonized information collection/reporting format with clear lines of reporting.

* Currently being developed under the IDENTIFY project.

national action plans included sequencing of FMD viruses for antigen typing, sequencing of the causative agents of PPR and CBPP for surveillance purposes, and sequencing of new or emerging pathogens in outbreak situations.

Participants appreciated the workshop and most of them expressed an interest in receiving more training in bio-informatics. The need for FAO and its Reference Centres to act as moderators and mentors in streamlining activities and guiding countries during the development of this initiative was emphasized, especially in assisting decision-making about which samples to submit for sequencing, and in supporting countries' interpretation of results.

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News

What's new in EMPRES-i?

The EMPRES-i genetic module: a new tool for linking epidemiological and genetic influenza information

Why develop the module?

Combining surveillance, genetic characterization and geomapping for animal influenza viruses can contribute to a better understanding of virus evolution and the epidemiology of influenza. Adding information such as agro-ecological farming system characteristics can support risk modelling of influenza emergence and spread in animal populations and possible transmission to humans, by refining influenza high-risk areas and risk factors. Integration of viral characteristics into an animal disease database such as the Emergency Prevention System Global Animal Disease Information System (EMPRES-i) therefore provides a unique tool for improving knowledge of disease epidemiology and ecology. More broadly, this tool can constitute an influenza gene observatory, and has already been utilized as such (FAO, 2012) to support risk assessment of human–animal influenza threats. The interest in such influenza genetic modules has already been confirmed by scientists in both the human and the animal health sectors. The tool was endorsed by the World Organisation for Animal Health/Food and Agriculture Organization of the United Nations (OIE/FAO) network of expertise on Animal Influenza (OFFLU)[4] in 2011.

Designing the module

EMPRES-i and OpenFluDB[5] developed an interface to link the EMPRES-i outbreak data and influenza virus sequences. This interface ranks all suitable isolates against all outbreaks, and vice versa, according to the best combination of three criteria: geolocation, host species, and time of sampling/event. It provides an automatic score of 0 to 100 percent, indicating the confidence of each of the most possible proposed linkages. When possible, manual validation of the linkages between sequences and outbreaks is subsequently carried out on this interface.

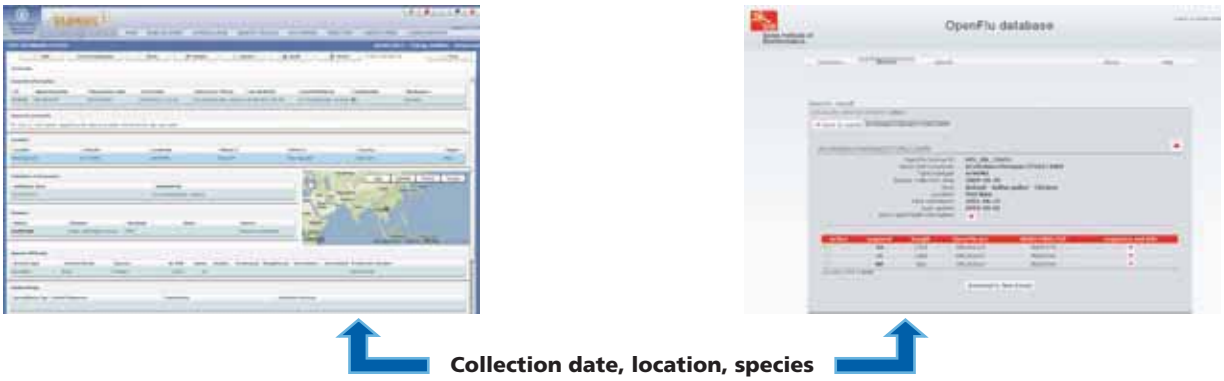
Application of the module

The EMPRES-i genetic module benefits from existing tools present within EMPRES-i – for spatial mapping, export of information, and interfaces with other databases such as the Global Livestock Production and Health Atlas (GLIPHA) – and from the phylogenic tools already developed by SIB. In particular, sequence similarity maps (SSMs) enable the identification of relative genetic distances for a large number of viruses. These maps can be used to study virus evolution and clusters, and may be combined with epidemiological information such as date, species and location

[4] www.offlu.net.

[5] A publicly available database on influenza, developed, curated and quality-checked by the Swiss Institute of Bioinformatics (SIB): http://openflu.vital-it.ch/browse.php

Figure 1: Linking EMPRES-i and OpenFluDB has required the development of Web services for data comparison, and the creation of an algorithm to function as the interface between both databases and to enable the exchange of data (no transfer)



to create spatio-temporal maps of virus clades and clusters that can be overlaid by other layers such as animal density maps. The SSMs can also be used for screening of virus distribution according to geographical location, host and time, with molecular markers of interest, for identification of potential drivers of virus evolution and the occurrence of reassortment events, and for knowledge gap analysis of virus sequences. The epidemiological information present in OpenFluDB for individual isolates can be completed in cases of validated linkages, with hyperlinks to EMPRES-i individual outbreaks provided in OpenFluDB.

FAO is currently applying this module to data available in various H5N1-endemic countries. Efforts are being made to validate links between the highest possible proportion of available H5N1 virus sequences and the outbreaks present in the EMPRES-i disease tracking module, and links to the active surveillance events described in reports and scientific papers. An average of about 35 percent of the H5N1 isolates present in OpenFluDB are linked to outbreaks present in EMPRES-i.

Using and contributing to the module

FAO aimed to make this genetic module publicly available before the end of 2012. It is expected that scientists – both epidemiologists and virologists – and decision-makers will make use of this tool to map combined information and to perform (risk) analysis. It is also hoped that scientists and technicians will contribute to FAO's efforts by suggesting new links between virus sequences and outbreaks/discoveries during active surveillance. An interactive system will be put in place for these contributions. In parallel, FAO has initiated efforts at the country level, so that the linkages between sequences and outbreaks are not lost; the four-way linking initiative at the human–animal interface represents one of these efforts (FAO, 2011). The

Figure 2: Example of possible outbreaks distribution map indicating available virus information

For a given outbreak (dot):
○ only epidemiological information available
● virus sequence available

interfaces with other influenza databases – such as EpiFlu™[6] of the Global Initiative on Sharing All Influenza Data (GISAID) and the Influenza Research Database (IRD)[7] – are also being explored and may provide additional information. Development of this module for other diseases is being considered, and has been initiated for foot-and-mouth disease.

Please visit the EMPRES-i website for further information.[8]

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[6] http://platform.gisaid.org/epi3/frontend#62bc89
[7] http://www.fludb.org
[8] http://empres-i.fao.org/eipws3g/#h=0

EMPRES participates in new EU-funded projects

Risk-Based Animal Health Surveillance Systems (RISKSUR) "Kick-Off" Meeting, 1 to 2 November 2012

The RISKSUR Kick-Off Meeting was organized jointly by the Royal Veterinary College (RVC) and accelopment AG (ACCEL) and held on the RVC Hawkshead Campus, Hatfield, United Kingdom of Great Britain and Northern Ireland.

The RISKSUR project[9] is a consortium of 12 partner institutions, including the Food and Agriculture Organization of the United Nations (FAO). It is funded by the Seventh Framework Programme (FP7) of the European Union (EU) for the funding of research and technological development in Europe. The project aims to develop decision support tools for the design of cost-effective, risk-based surveillance systems that integrate the most recent advances in epidemiological methodologies, are based on an interdisciplinary approach and are tailored to the needs of individual EU Member States. This aim will be achieved through the development of evaluation frameworks for animal health surveillance system designed for three surveillance objectives regarding livestock diseases:

1. early detection of exotic, new (emerging) and re-emerging diseases;
2. demonstration of freedom from diseases and infections;
3. determination of disease frequency and detection of cases of endemic animal diseases.

The methodologies will be applied to diseases representing key risk scenarios within EU member countries and selected countries outside the EU with particularly challenging system constraints, such as inadequate veterinary infrastructure.

The overall duration of the project is 36 months, the total budget is €3.8 million and the project work plan is divided into eight work packages (WPs). WP 1 will develop a conceptual generic framework for designing risk-based surveillance systems, including the novel scientific methods that will be developed for each of the three surveillance objectives in WPs 2 to 4. In WP 5 the results of WPs 1 to 4 will be evaluated by assessing the efficiency of the single and multi-objective surveillance systems developed. Transfer of knowledge and technology to stakeholders in policy and industry will be facilitated through the development of tools for implementing the systems, in WP 6, and through communication and training in WP 7. WP 8 will cover overall project coordination and management.

FAO will contribute to WPs 5, 6 and 7.

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ASFORCE "Kick-Off" Meeting, Lisbon, Portugal, 22 to 23 October 2012

ASFORCE is a European consortium funded under the European Union' (EU's) Seventh Framework Programme (FP7) for "Targeted Research Effort on African Swine Fever" (ASF), with 18 partners. The ASFORCE Kick-Off Meeting took place in Lisbon,

[9] www.fp7-risksur.eu

Portugal on 22 and 23 October. Its objectives were: i) general discussion of the project; ii) finalization of a work plan and collaboration procedures for partners; and iii) agreement on the implementation of necessary tasks – the "who, when, where and how?". Following the spread of ASF throughout Africa, the Caucasus and the Russian Federation, Europe is at high risk of disease introduction via legal or illegal movements of animals and animal products, particularly through its eastern borders. Research efforts across Europe should therefore continue to provide the science for preparedness in this evolving situation.

The ASFORCE project will last for 36 months and its work plan covers five major themes, corresponding to its objectives, which are divided into 19 work packages of tasks.

The five themes are:

1. project coordination and management;
2. ASF prevention, control and eradication models;
3. pig–wild boar–Argasidae interactions relevant to ASF epidemiology;
4. development of tools for protecting against ASF (vaccines and improved diagnostic tests);
5. training and knowledge transfer.

The Food and Agriculture Organization of the United Nations Emergency Prevention System (FAO EMPRES) participates in themes 2, 3 and 5, mainly through the implementation of field activities in Eastern Europe and the Caucasus.

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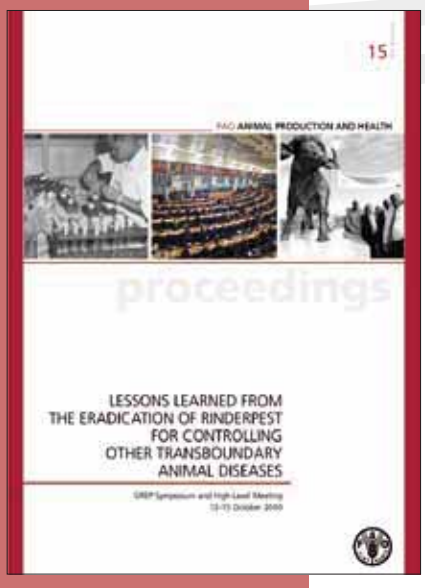

Publications

FAO Animal Production and Health publications

FAO Animal Production and Health Proceedings No. 15: *Lessons learned from the eradication of rinderpest for controlling other transboundary animal diseases*
(http://www.fao.org/docrep/016/i3042e/i3042e.pdf).

IN MEMORIAM: Dr Boubacar M'Baye Seck, Coordinator FAO-ECTAD Bamako (Mali)

A baobab has fallen, a library has burned, Dr Boubacar M'Baye Seck has left us. He was for all of us who knew him in Mali, in Africa and around the world the incarnation of humility, humanity, dedication, competence, rigour and professional excellence, but also of a sense of humour and *joie de vivre*. He will remain a model for many of us.

On the morning of Thursday 16 August 2012, Dr Seck died with dignity and in family privacy in Bamako, without much noise, in the image of what his life had been. It would be pretentious to summarize his life in a few lines.

A graduate of the Veterinary School of Maisons-Alfort, France and the *Institut Pasteur*, he devoted his professional life to animal health in Mali and Africa. On his return from training in France he joined the Central Veterinary Laboratory in Bamako, of which he became the Director General and which he raised to the rank of prestigious laboratory in the region. He played a central role in the establishment and development of the Pan African Veterinary Vaccine Centre (PANVAC); from August 1996 to July 2000 he was recruited by the Food and Agriculture Organization of the United Nations (FAO) as Expert Chief Technical Advisor to PANVAC, based in Debre Zeit, Ethiopia. He returned as Director of the centre from February 2004 to November 2005, under a technical assistance contract between the African Union Interafrican Bureau for Animal Resources (AU-IBAR) and the International Cooperation Centre of Agricultural Research for Development's Department of Animal Production and Veterinary Medicine (CIRAD-EMVT). In January 2006, FAO recruited him as Project Coordinator of Technical Cooperation Programme project TCP/RAF/3016, the keystone of FAO support to the control of avian influenza in West and Central Africa. This project laid the groundwork for creation of FAO's Emergency Centre for Transboundary Animal Disease Operations (ECTAD) Unit in Bamako in 2006. Subsequently, he acted as Laboratory Expert in the same unit, before becoming its Coordinator in July 2010. Through his valuable advice and numerous technical support missions, he has contributed immensely to strengthening the capacities of veterinary services and diagnostic laboratories in the region.

This man, this great man, this monument has left us, leaving behind him

inconsolable family members, relatives, friends and colleagues. To summarize this exceptional man, we say that Dr Seck lived fully and effectively. Since the announcement of his death, waves of sympathy and initiatives to honour his memory have flowed in from Mali, Africa and around the world, including the decoration as Knight of the Order of Mali National Merit awarded by the State of Mali posthumously, providing tangible proof of the esteem and consideration that we all feel for him. A page has turned, but we are confident that Dr Seck continues to remain in all of us. May we have the strength to continue his work and take inspiration from the legacy he has left us. This is the only tribute that we can pay to him that comes close to the dimensions of the man he was.

Dr Seck, *Frère*/Brother Boubacar, Tonton Seck, we miss you already.

Repose en paix et que la terre d'Afrique et du Mali, à laquelle tu as tant donné, te soit légère.

NEWS FLASHES

Peste des petits ruminants (PPR) has been reported for the first time in the Republic of Angola, on 8 October 2012, following abnormal mortality of goats in three of the country's northern provinces, including the enclave of Cabinda. This incursion appears to be related to the latest outbreaks of the disease in the neighbouring Democratic Republic of the Congo. A Food and Agriculture Organization of the United Nations (FAO) Crisis Management Centre – Animal Health (CMC-AH) mission was deployed in October 2012 to support the Angolan veterinary services in assessing the epidemiological situation and to make recommendations for containing the disease and stopping its spread to other provinces and neighbouring countries. For the short term, Angola was highly recommended to undertake a vaccination campaign coupled with sero-surveillance.

Contagious bovine pleuropnemonia (CBPP): The World Organisation for Animal Health (OIE) was notified of an outbreak of CBPP on 27 September 2012, following incursion of the disease into the Niamina Dankunku District of Central River Region in the Republic of the Gambia. CBPP has not been reported in the Gambia since 1971 when the last outbreak occurred. A CMC-AH mission was deployed in mid-October 2012 to assess the situation and document the risk factors that may amplify and disseminate the disease in the country and within the region. Since then, FAO has prepared a Technical Cooperation Programme (TCP) project to support the government's response; the TCP project includes the implementation of vaccination and awareness campaigns.

Rift Valley fever (RVF) was suspected in Mauritania in 2012 following human cases, mostly in the country's southern regions, although few symptoms were reported in animal populations. Subsequent laboratory analyses showed active circulation of the virus (a high number of IgM+ animals) together with abortions, especially in small ruminants and camels. As well as the RVF outbreak of 2010 in Adrar, the 2012 occurrence was highly correlated to the weather conditions associated with heavy rains, which favour the multiplication of mosquito vectors. Following a joint CMC-AH and FAO Subregional Office for North Africa mission, Mauritania was recommended to strengthen surveillance systems for the disease, and a Central Emergency Response Fund (CERF) project was developed to address the needs for short-term control actions.

Highly pathogenic avian influenza (HPAI) was detected in chickens and ducks in Central Java, Yogyakarta and East Java Provinces of Indonesia, between mid-September and November 2012, by local government livestock services via participatory disease surveillance and response (PDSR), with further investigation by the regional Disease Investigation Centre (DIC) of the Directorate General of Livestock and Animal Health Services, Ministry of Agriculture. Preliminary sequence analysis of the HA gene of representative isolates places these viruses within clade 2.3.2.1, possibly clustering close to A/Hong Kong/6841/2010-like viruses. The introduction of a new clade of an avian influenza virus after nine years with only clade 2.1 viruses circulating in Indonesia presents considerable challenges for outbreak containment, response, prevention and control.

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