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EMERGENCY PREVENTION SYSTEM

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Cattle drinking at a watering hole in the Niger

Global Rinderpest Eradication Programme (GREP) – current status of rinderpest eradication

In spite of the various obstacles that have confronted the eradication of rinderpest over the decades, the disease has been at an almost undetectable level for the last 15 years, and certainly for the last seven. As of early 2009, the Emergency Prevention System for Transboundary Animal and Plant Pests and Diseases (EMPRES) believes that the virus has been eliminated from all previously infected areas in Europe, Asia, the Near East, the Arabian Peninsula and Africa. This has been a remarkable achievement for veterinary science and a victory for national, regional and international communities (page 2).

Live bird market (LBM) surveillance in China

LBMs are believed to play a key role in human exposure to birds infected with H5N1 highly pathogenic avian influenza (HPAI) and other avian diseases. The markets can also be a mechanism for disease spread into previously uninfected areas, posing additional risk of agricultural losses and human death (page 12).

GAI HUAWU, CHINA ANIMAL HEALTH EPIDEMIOLOGY CENTER, QINGDAO

Environmental and bird sampling in a live bird market in China – FAO-coordinated live bird market survey in southern China

AND...

GWENAELLE DAUPHIN, FAO

HPAI laboratory diagnosis training at a national laboratory in Garoua, Cameroon

FAO global initiatives on regional veterinary laboratory networks

For the past decade, FAO has developed a strong institutional basis for networking. Under Technical Cooperation Programme (TCP) projects on avian influenza (AI), implemented from 2006 to 2008, FAO has taken a regional approach to its support to laboratories, promoting regional cooperation through practical training, workshops and meetings (page 14).

This issue covers the period January to June 2009

Rinderpest

The Global Rinderpest Eradication Programme (GREP) status report: Its achievements and the action required to achieve the global declaration in 2010

Introduction

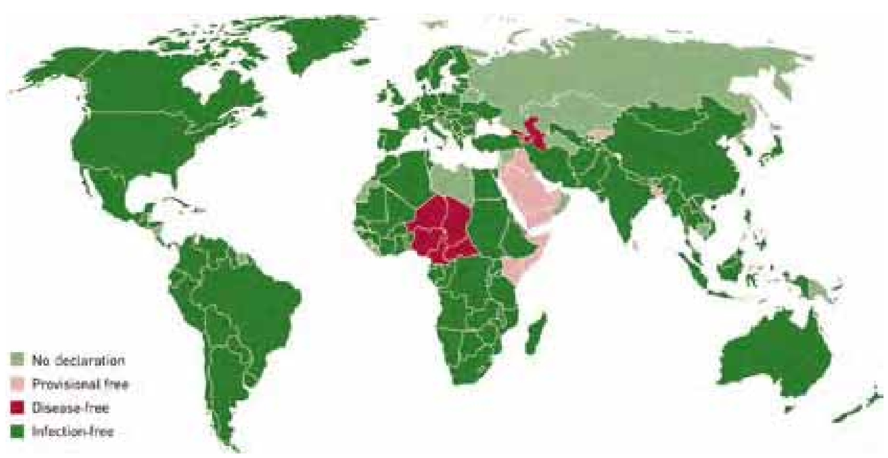
It could be argued that rinderpest is the most dreaded cattle disease, because throughout its epidemic history it has caused massive losses of livestock and wildlife on three continents, and has been responsible for several famines and the loss of draught power in agricultural communities during the eighteenth, nineteenth and twentieth centuries.

Rinderpest diagnosis was given a boost in the late 1980s, when the Joint FAO/ International Atomic Energy Agency (IAEA) Division set up a large laboratory network of trained scientists with links to FAO's Animal Health Service section responsible for infectious diseases (which later became the Emergency Prevention System for Transboundary Animal and Plant Pests and Diseases [EMPRES]).

Current status

One of the tools developed for working towards rinderpest eradication is the World Organisation for Animal Health (OIE) Pathway. This is a step-by-step approach – passing through *disease-free* without vaccination status before reaching *infection-free* status – backed by epidemiological surveillance and analysis. Results are submitted as a dossier to OIE, for evaluation and, ultimately, international recognition of freedom from rinderpest.

Global rinderpest situation as of February 2009* (according to the OIE pathway)



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*An updated map will be provided in the next *EMPRES Bulletin* issue.

The countries that still have to complete the accreditation process by end-2009 are listed in the following table.

FAO support to countries/territories in 2009 and 2010*

Activity	Countries/territories
Assistance with rinderpest dossier formulation	Bangladesh, Cambodia, the Comoros, Kosovo, Liberia, Sao Tome and Principe
Dossier preparation for submission to OIE	Democratic Republic of Korea, the Gambia, Lao People's Democratic Republic, Sierra Leone
Assistance with strategy development, provision of kits and sampling framework	Azerbaijan, Cameroon, Central African Republic, Chad, Djibouti, Georgia, Israel, Kazakhstan, Kuwait, the Niger, Nigeria, Qatar, Russian Federation, Saudi Arabia, Somalia, Sri Lanka, Syrian Arab Republic, United Arab Emirates, the West Bank and Gaza Strip, Yemen
Sampling undertaken, awaiting kits from FAO	Azerbaijan, Cameroon, Djibouti, Kuwait, Nigeria, the Niger, Somalia, Syrian Arab Republic, Yemen
Surveillance still to be undertaken	Central African Republic, Chad, Georgia, Israel, Kazakhstan, Qatar, Saudi Arabia, Sri Lanka, United Arab Emirates, the West Bank and Gaza Strip

*An updated table will be provided in the next *EMPRES Bulletin* issue.

Asia, the Near East and Eastern Europe

India has been free of rinderpest since 1995, after the last reservoirs of infection were identified and eliminated in Tamil Nadu and Karnataka. OIE accredited India as free of rinderpest infection in 2004. China was declared infection-free in May 2008. The rest of Southeast Asia has likely been free from rinderpest since the late 1950s. Elsewhere in Asia too, surveillance exercises provide evidence that reservoirs of infection had been resolved by about that time. Mongolia has presented convincing evidence of freedom and there is little doubt that the Russian Federation is also free from infection, but this needs to be officially recognized by the international community. Sporadic rinderpest outbreaks in Georgia (in late 1989 continuing into early 1990), Siberia/Mongolia (in 1991 to 1993) and the Amur region of the former Union of Soviet Socialist Republics (USSR) (in 1998) can almost certainly be ascribed to reversion to virulence of the vaccine used in attempts to create an immunized buffer zone on the borders of the former USSR, and later the Russian Federation, with neighbouring countries.

Rinderpest has not been reported in Central Asian States for several decades, but no current data are available to prove the absence of virus activity in the region. An Italian-funded project (GTFS/INT/907/ITA), provided technical assistance for implementing regional activities and a surveillance methodology to generate data on the presence or absence of a viral rinderpest footprint. All the beneficiary countries – Afghanistan (in 2007), Pakistan (in 2007), Tajikistan (in 2007) and Uzbekistan (in

2008) – submitted their dossiers to OIE and all have been recognized as infection-free. Infection-free status was also granted to Armenia (in 2009), Belarus (in 2008), Kyrgyzstan (in 2009) and Serbia (in 2008), through Irish trust funds (GCP/INT/971/IRE) and FAO regular programme funds.

All countries in the Near East region are committed to the GREP deadline of 2010 and no clinical cases have been reported in the region for more than ten years. Some countries have already been declared infection-free: Iraq (in 2009), the Islamic Republic of Iran (in 2008), Jordan (in 2008), Lebanon (in 2008), Oman (in 2009) and Turkey (in 2005).

Africa

Rinderpest virus of African lineage I persisted in Ethiopia until 1995 (one epidemic extended into areas that are now part of Eritrea) and in the Sudan until 2001. In both countries, extensive serological monitoring of young livestock born after the last vaccine applications in the region, as well as exhaustive participatory disease search approaches, provide convincing evidence that the virus is no longer circulating. These were the last strongholds of African lineage I rinderpest virus, which has almost certainly joined the Asian lineage in being consigned to history (although some laboratory repositories around the world retain isolates).

The OIE Pathway accreditation process provides assurances that both West and Central Africa have been free from rinderpest since the last cases occurred in the Burkina Faso/Ghana border area in 1988. North and Southern Africa have been free for over a century, with the exception of Egypt, which reported its last outbreak in 1987.

The Somali ecosystem in Africa

Rinderpest virus strains of lineage II have been suspected to be endemic in the Somali ecosystem, an area covering southern Somalia and the adjoining parts of Ethiopia and Kenya. In 1994, African lineage II rinderpest virus was detected in East Africa after an apparent absence of more than 30 years. By 2004, only the Somali ecosystem remained as a suspected unresolved focus of rinderpest infection (based on serological evidence). Considerable attention has been directed to this area over recent years. Several serological studies conducted between 2002 and 2007 recorded some sero-positive findings, suggesting possible virus circulation and a possible undetected focus of active lineage II rinderpest virus activity. Concern that the virus was continuing to circulate led the Food and Agriculture Organization of the United Nations (FAO), through its Global Rinderpest Eradication Programme (FAO-GREP), and the African Union Interafrican Bureau

Cattle drinking at a watering hole in the Niger

ADO YOUSSOUF, FAO

for Animal Resources (AU-IBAR) to undertake follow-up field investigations in late 2007. These focused on sero-positive sites at Gedo, Lower Juba and Middle Juba, in southern Somalia and the adjacent parts of Kenya and Ethiopia. Re-sampling and re-testing of sites revealed that the sero-positivity seen earlier was due to mis-ageing of sampled animals with a vaccination history. Confidence that rinderpest is no longer circulating was augmented by the repeatedly sero-negative results obtained from tests on rinderpest-susceptible wildlife species in the region, between 2002 and 2007. Ethiopia was declared infection-free in 2008, Kenya in 2009, and the Somalia dossier was sent to OIE for evaluation in September 2009.


GIAMPIERO DIANA, FAO

Cooperative dairy development programme Milk Vita in Bangladesh

GREP success story

Target achieved

The last known rinderpest outbreak was reported in 2001. Based on the investigations described in the previous section, it was concluded that African lineage II has likely joined other lineages in extinction. During the eradication programme, GREP assumed responsibility for assisting the veterinary services of rinderpest-affected countries in eliminating the infection, halting vaccination, and developing evidence of the infection's demise through clinical disease searches, serological surveillance sampling, contingency planning and laboratory support. All of GREP's efforts have been in accordance with the rules developed by OIE, which is the body with ultimate responsibility for evaluating and adjudicating countries' evidence of disease eradication for rinderpest.

Partnerships and donor support

GREP relies on its partnerships with OIE, economic blocs and regional specialized organizations, such as AU and the South Asian Association for Regional Cooperation (SAARC), and on numerous donor agencies, such as the European Commission, the United States Agency for International Development (USAID), the United Kingdom's Department for International Development (DFID), the Government of Ireland, and Italy's *Cooperazione Italiana allo Sviluppo.* However, GREP's most important partners have been the countries themselves. In several situations, FAO Technical Cooperation Programme (TCP) project funding has been used to excellent effect in assisting national veterinary services in controlling rinderpest outbreaks rapidly and in strengthening laboratory diagnostic capacity, emergency preparedness planning, surveillance and capacity building. Few donors have this rapid response capability, which is highly appreciated by recipient countries. GREP has also been instrumental in drafting and revising the OIE Pathway (a standard-setting activity), surveillance strategies and other guidelines leading to accreditation of eradication.

Promoting vaccination
In the early stages of eradication, FAO adopted the strategy of implementing widespread vaccination campaigns for cattle and buffaloes.

Virus characterization
Following molecular analyses by the World Reference Laboratory for Rinderpest Paramyxovirus at Pirbright in the United Kingdom, and FAO's support activities, rinderpest virus strains were grouped into three lineages: lineages I and II are from Africa, and lineage III is composed of virus strains isolated from Asia and the Near East.

Coordination of the rinderpest eradication campaign
During an FAO Expert Consultation in Rome in 1992, it was agreed that eradication campaigns have to be coordinated at the regional level, as isolated national actions would lead to only sporadic and unsustainable or temporary improvements. FAO promoted the establishment of the Pan African Rinderpest Campaign (PARC), which covered 34 countries in Africa until 1999, and the West Asian Rinderpest Eradication Campaign (WAREC), which covered 11 countries in the Near East between 1989 and 1994. PARC was replaced by the Pan African Programme for the Control of Epizootics (PACE), with 30 countries, and the Somali Ecosystem Rinderpest Coordination Unit (SERECU), which was to develop a specific project for regrouping Ethiopia, Kenya and Somalia. Activities included the exchange of epidemiological support and technical assistance with the Pan African Veterinary Vaccine Centre (PANVAC) in Ethiopia. The maintenance of good relations among these agencies has been critical in GREP's success.

Network of epidemiology and laboratories
The elimination of transboundary animal diseases such as rinderpest depends on international coordination. Concerted efforts by national authorities, assisted by reference laboratories for confirmatory diagnosis or vaccine development and quality control, have been crucial for the eradication of rinderpest.

Disease surveillance and participatory disease search
To address specific needs in rinderpest epidemiology and risk-based surveillance, participatory disease search techniques were developed and validated for the detection of rinderpest, for providing epidemiological understanding of disease maintenance, and for verifying the eradication of the disease.

Remaining activities
Surveillance
Support is still needed for countries that are undertaking surveillance, laboratory testing and dossier formulation. FAO has invested in the Africa region (TCP/RAF/3202 Surveillance for Accreditation of Freedom from Rinderpest) to support countries' freedom status in Cameroon, the Central African Republic, Chad, Djibouti, Kenya,

the Niger and Nigeria. National TCP/YEM/3101 is supporting Yemen's surveillance activities. Through European Commission support, FAO, AU-IBAR and non-governmental organizations (NGOs) are coordinating the final accreditation of rinderpest eradication in the Somali ecosystem. Other countries are being supported through the Irish Trust Fund for GREP or through FAO/EMPRES regular programme budgets. Support comprises technical assistance for the formulation of surveillance strategies, field surveillance, the provision of kits for testing the animal samples collected, and technical assistance for the formulation of dossiers.

Joint FAO-OIE Committee for the Rinderpest Global Declaration

Senior management of both FAO and OIE have accepted a proposal for forming a joint FAO/OIE committee to review and monitor the process for ensuring global recognition of the Declaration of the Eradication of Rinderpest. The committee will be charged with producing a comprehensive report of its findings to the Director-Generals of both organizations. It will base its work on information provided by the GREP Secretariat regarding regional, global and country epidemiological and scientific evidence, reference laboratories and historical records. The approaches that the OIE Ad Hoc Group on Rinderpest uses to evaluate country submissions (dossiers) will also be reviewed. The committee will have access to the findings of all possible documents and data related to claimed, previously known and current rinderpest situations, for review. FAO and OIE will develop terms of reference for the committee, which will have the GREP Secretariat as its secretariat.

A. GANDOLFI

Cattle being herded across the Niger river at Diafarab

Biological materials survey

GREP is to develop a mechanism for reaching international agreement on the list of laboratories where viruses and sera can be maintained for research purposes, and vaccine master seeds and vaccine banks can be established and kept under appropriate biosecurity conditions. A post-eradication strategy also needs to be defined, including the declaration that all viruses, biological samples and vaccines at all sites other than these laboratories have been destroyed.

FAO's historical account of rinderpest eradication

FAO plans to prepare a historical account of rinderpest eradication, which will be written by key players and recognized experts from Africa, the Near East, Asia and countries where the disease occurred during recent decades. It will describe the unfolding of events that led to eradication, the tools developed, the advances and the challenges. The account will highlight the contributions of partners and donors, the economic benefits and impact of eradication, and lessons learned that could be used in the control and elimination of other transboundary animal diseases.

Formulation of the post-rinderpest declaration strategy

A strategy for monitoring the rinderpest situation after eradication has been declared will be drafted, and funds for its implementation identified. The activities described in the previous two paragraphs are also part of this post-eradication phase.

Conclusion

Although the eradication of rinderpest has faced several challenges over the decades, the disease has rarely been detected during the last 15 years. As of early 2009, it is believed that the virus has been eliminated from previously infected areas in Europe, Asia, the Near East, the Arabian Peninsula and Africa. This has been a remarkable achievement for veterinary science, a demonstration of countries' commitment to a public good, and a victory for the international community.

Contributors: Submitted by F. Njeumi (FAO)

Peste des petits ruminants (PPR)

A challenge for small ruminant production

Role of small ruminants and PPR distribution

Sheep and goats are among the major livestock species kept by low-income populations throughout the world. Goats, the "cattle of the poor", and sheep are reared as sources of not only milk and meat for family consumption, but also income that can be mobilized easily for paying household expenditures, particularly in lean times. In addition to this important economic role, sheep and goats are significant in socio-cultural activities such as during funerals, for use as dowries, and during festivities and holidays.

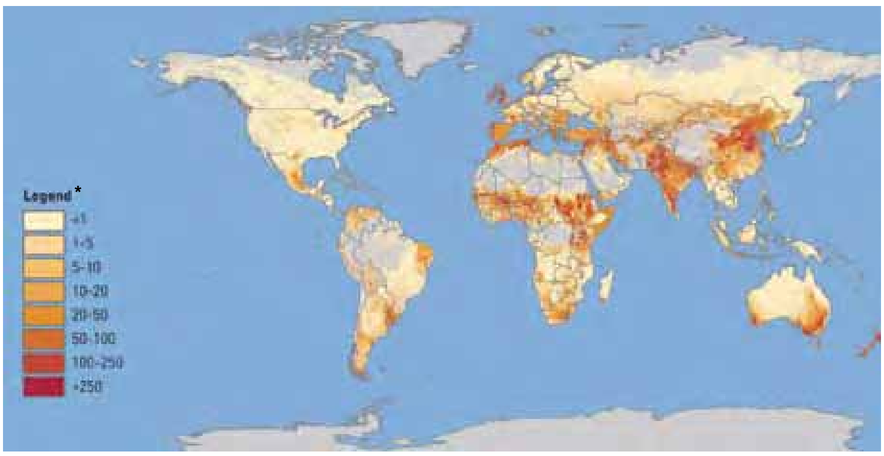
PPR is a highly contagious transboundary animal disease of wild and domestic small ruminants caused by a paramyxovirus in the same family as the rinderpest virus of cattle and the human measles virus.

The typical clinical manifestation of PPR is the acute form, which is characterized by high fever, depression and cessation of eating, followed by eye and nasal discharges, erosive lesions in the mouth, pneumonia and severe diarrhoea. Many animals in a flock can be affected simultaneously, and a high percentage of them will die. PPR is an important killer of small ruminant populations.

Since its first description in 1942 (in Côte d'Ivoire), the geographical distribution of PPR has steadily expanded to cover large regions of Africa, the Near East and Asia.

The important direct economic losses caused by the disease are often aggravated by the sanitary measures imposed by authorities to control animal movements and

Distribution of small ruminant density



Source: FAO/Gridded Livestock of the World (GLW).
* Number of animals/km².

restrict trade in their by-products. Because of the high negative economic impact in countries affected by PPR, the disease is one of the priorities of FAO's Emergency Prevention System for Transboundary Animal and Plant Pests and Diseases (EMPRES) programme.

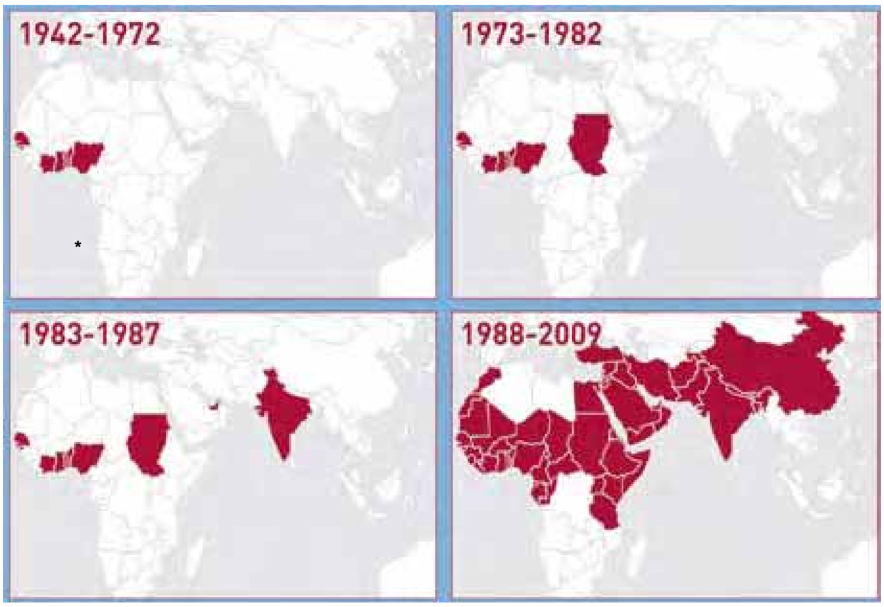
In the early 2000s, an animal disease consultancy identified PPR as one of the important animal diseases to be taken into consideration in poverty alleviation policies.

The global small ruminant population is estimated to be 1 801 434 416 animals, of which, according to the known geographical distribution of the disease, the total population at risk is 1 126 910 710 (63 percent).

FAO has proposed the following strategy for mitigating the impact of PPR and other diseases of importance to small ruminant production:

- Governments and stakeholders should be sensitized to the importance of PPR and other diseases of importance to small ruminants, their impact, and the risks of spread to new areas and region.
- Global and regional strategies and road maps for PPR prevention and control efforts should be developed and monitored (especially regional approaches for surveillance and vaccination).
- There is need to develop understanding of how the disease epidemiology/ecology relates to socio-economic dimensions and farming systems, and to promote improved hygiene, marketing and slaughtering practices and targeted interventions.

Known PPR geographical expansion since 1942



CLAUDIA CIARLANTINI, FAO

- Preventive measures such as vaccination should be supported: Very efficient live attenuated PPR vaccines exist, which provide life-long protection for small ruminants.
- PPR campaigns should be combined with other efforts to improve small ruminant flock health and disease prevention, thus maximizing the available resources.

Contributors: Submitted by A. Diallo (FAO) and F. Njeumi (FAO)

Live bird market surveillance in China

Avian influenza (AI) has attracted worldwide attention because highly pathogenic avian influenza (HPAI) virus subtype H5N1 can cause fatal infections, not only in poultry but also in humans. There are risks to animal and human health throughout the entire poultry production and marketing industry. As each link in the poultry market chain interacts with the following link, the entire poultry production and distribution system has to be examined for patterns of disease risk.

GAI HUAWU, CHINA ANIMAL HEALTH EPIDEMIOLOGY CENTER, QINGDAO

Environmental and bird sampling in a live bird market in China – FAO-coordinated live bird market survey in southern China

Live bird markets (LBMs) are thought to be a particularly high-risk section of the industry because poultry and people from different locations come into contact with each other in one place and then disperse. LBMs likely play a role in humans' exposure to birds infected with H5N1 HPAI and other avian diseases. They also serve as a possible mechanism by which disease is spread by both birds and humans into previously uninfected areas, posing additional risk of agricultural losses and human death. The risks present in an LBM are likely to differ depending on whether the LBM is a small-volume, rural market trading only a few species, or a large, urban market, where many species are traded. Risks also depend on whether the LBM trades poultry only, poultry and wildlife species, or wildlife species only. LBMs are either fixed and open daily, or moveable and operational on one or more days a week, which provides a very dynamic system for disease entry and dispersal.

LBMs are considered an important epidemiological mechanism through which the spread of H5N1 HPAI has already occurred, thus highlighting the need for active disease surveillance. The identity and epidemiology of viruses circulating in China's LBMs are not widely known, and the risk factors associated with detection of HPAI at LBMs are not well understood or quantified. Identification of specific risk factors for the presence of H5N1 HPAI could lead to a better understanding of virus epidemiology and help identify which measures (regulatory or other) could effectively decrease animal and human health risks.

HPAI surveillance in LBMs has already been extremely useful in the detection of HPAI H5N1 infection in China, where LBM surveillance has been implemented for several years through the national HPAI surveillance programme. To optimize the probability of finding the virus in these markets and to improve understanding of how LBMs interrelate, FAO's HPAI programme in China, funded by the United States Agency for International Development (USAID), has implemented a pilot study. This aimed to detect H5N1 and other low- and high-virulence viruses using environmental and classical sampling methodologies in LBMs in Hunan, Yunnan and Guangxi Provinces.

During China's successful surveillance of LBMs for avian influenza viruses (AIVs) in recent years, it appears that much of the sampling has been done directly from birds. However, environmental sampling has proved useful in other places, including LBMs in Indonesia, and tends to be a less invasive method. If proven effective and efficient from the FAO pilot study results, environmental sampling may be used more extensively in AI surveillance programmes.

Part of the FAO study focused on training enumerators on sample and data collection activities. In addition, approximately 60 epidemiologists and laboratory staff have been trained in Hunan, Yunnan and Guang Xi. The training for and execution of the study appears to have been a valuable exercise for all stakeholders: FAO, the China Animal Health Epidemiology Center, as well as provincial and local animal health authorities. As the survey and diagnostic testing results become available, valuable insight is expected to be gained regarding the risk factors of LBMs. Equally important, the study results will provide lessons for the development of similar studies and survey questionnaires in the future.

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Blood samples being taken in a live bird market in China – FAO-coordinated live bird market survey in southern China

Contributors: Submitted by E. Marshall (FAO) and V. Martin (FAO)

FAO global initiatives on regional veterinary laboratory networks

For the past decade, FAO has been very active in diverse network building initiatives and has developed a strong institutional base in networking. Its Animal Health Service, through a special Emergency Prevention System for Transboundary Animal and Plant Pests and Diseases (EMPRES) programme, has developed an early warning and response system, driven from FAO Headquarters. This system combines official information with that generated by technical projects, reports from technical officers in FAO country offices on consultancy missions, and personal contacts. It provides an analysis of a situation through bulletins, electronic messages and reports, for better disease prevention, containment and control.

GWENAELLE DAUPHIN, FAO

HPAI laboratory diagnosis training at a national laboratory in Garoua, Cameroon

Under its Technical Cooperation Programme (TCP) projects for avian influenza (AI) implemented from 2006 to 2008, FAO has taken a regional approach to its support for laboratories, especially through implementation of regional training workshops and meetings. Following the conclusion of these TCP projects, FAO has continued to support regional networks and activities, which are coordinated by Emergency Centre for Transboundary Animal Disease Operations (ECTAD) regional offices at Regional Animal Health Centres (RAHCs) and other FAO decentralized units. Global coordination of the regional networks is done from FAO Headquarters. As envisioned in the Global Framework for the Progressive Control of Transboundary Animal Diseases (GF-TAD) initiative, FAO promotes a harmonized approach to regional laboratory and epidemiological networking. A networking programme has been elaborated for 13 regions (see map). FAO also attempts to consolidate networks in regions where appropriate structures are already in place. Sustainability of these networks is a key issue, which FAO addresses through regional economic communities (RECs) to anchor the networks' regional political and economic relevance and foster ownership by member countries.

In line with its approach to AI and other transboundary animal diseases (TADs), and based on supporting local and regional initiatives as part of its global programme to prevent and control HPAI and other zoonotic diseases, FAO is now supporting the development of regional veterinary laboratory networks for improved diagnosis and monitoring of animal diseases, particularly AI.

These networks aim to:

- support local testing of suspect samples for AI and other TADs;
- improve the quality of disease surveillance and disease diagnosis;
- build the synergy and efficiency of laboratory and epidemiological expertise;
- break the isolation of national teams in developing countries;
- facilitate a dynamic approach to interaction among countries;
- promote consistency and rigour in methodology;

FAO's global vision for regional laboratory and epidemiology networks

CHRISTOPHER HAMILTON, FAO

Note: The regional laboratory and epidemiology networks have been established taking into consideration RECs.

- build trust for enhanced transparency and mutual confidence in disease information exchange.

Activities implemented under these laboratory networks will focus on improved quality assurance through accreditation and proficiency testing programmes and implementation of validated, standard laboratory procedures; provision of training for laboratory personnel; provision of supplies and equipment; linking of laboratory data and activities to surveillance; and promotion of national self-sufficiency and sustainability of laboratory services.

In parallel to the laboratory networks, close collaboration with epidemiological surveillance teams is essential for these efforts. FAO has initiated regional epidemiological surveillance networks in several regions. These support harmonization of animal health information systems, increased preparedness and upgrading of national animal disease surveillance structures. An annual coordination meeting is to be held at FAO Headquarters involving all the focal points of laboratory and epidemiological surveillance networks.

A regional approach assists the improvement of regional laboratory capacities, by providing harmonized upgrading for AI laboratory diagnosis and catalysing experience and information sharing. Such networks also facilitate linkages with global systems for TAD preven-

Laboratory training at LNERV, December 2007, Dakar, Senegal

BOUBACAR M'BAYE SECK, FAO


GWENAËLLE DAUPHIN, FAO

Laboratory training at LANAVET, October 2007, Garoua, Cameroon

tion and control in the context of increased globalization in trade and population movements. Moreover, good laboratory practices and the laboratories' engagement in quality assurance schemes can be stimulated at the regional level. Proficiency tests for AI and other major diseases must be part of this strengthening process. Pilot/service laboratories in each region are also necessary in providing countries with easy access to reliable testing services and standardized reference reagents, and providing a setting for regional training. FAO works in all these fields. It has assisted with the selection and strengthening of regional laboratories and has organized and supported several annual meetings and regional workshops. This includes supporting proficiency testing for AI testing (in collaboration with Italy's *Istituto Zooprofilattico Sperimentale delle Venezie* [IZSVe]). A total of 26 countries from Africa and the Near East participated in a proficiency test conducted in October 2008. The overall results of this first exercise will be described in a future *EMPRES Bulletin.*

Through FAO's H5N1 highly pathogenic avian influenza (HPAI) projects, diagnostic capacities and laboratory capabilities have been dramatically upgraded in many developing countries and countries in transition. Project activities supporting laboratories have focused on training (AI diagnostic methods including virus characterization, and good laboratory practices and quality assurance), renovation or rehabilitation of laboratory facilities, and supply of equipment and reagents. Scientists in more than 40 countries have had the opportunity of attending technical meetings and conferences. However, continuous support is still required to ensure the sustainability of the progress made during the HPAI crisis.

The second international conference on HPAI, held in Beijing, China, in January 2006 recommended the creation of Regional Animal Health Centres (RAHCs). FAO, the World Organisation for Animal Health (OIE) and the African Union Interafrican Bureau for Animal Resources (AU-IBAR) established joint RAHCs in Bamako (Mali) in April 2006 and in Gaborone (Botswana) in June 2007. A joint FAO/AU-IBAR RAHC was established in Nairobi in July 2007; two other joint OIE/FAO RAHCs have been established for North Africa (Tunis) and the Near East (Beirut). These centres help coordinate and harmonize actions to control HPAI and other TADs.

The role of the RAHCs and FAO country units is crucial in providing guidance and establishing standard operating procedures for the networks, and in coordinating the implementation and maintenance of new networks, where no such structures yet exist. During the initial stages of the networks, technical assistance to RECs is essential, and can be provided by the ECTAD regional units at RAHCs, other FAO units and donor-funded projects. The recent Partnership for Africa Livestock Development, Poverty Alleviation and Sustainable Growth in Africa (Alive) study on regional networking in Africa (September 2008 to April 2009) appreciated and endorsed the steps already taken by FAO, and recognized FAO's crucial role in guiding the process for setting up REC-hosted epidemiological surveillance networks. The closing ALIVE workshop, held in Nairobi in May 2009 concluded that: *"The RAHCs are urged to continue acting as initiators in the short term, catalysts in the medium term and technical back-stoppers in the long term."*

BOUBACAR M'BAYE SECK, FAO

Laboratory workshop at LNERV, 21 to 25 July 2008, Dakar, Senegal

The West and Central Africa Veterinary Laboratory Network for Avian Influenza and other Transboundary Diseases (RESOLAB) provides an interesting example. Since 2008, RESOLAB has been coordinated by the RAHC in Bamako, Mali.

Its immediate objectives are to:

- enhance the effectiveness and efficiency of national veterinary diagnostic laboratories;
- improve communication among laboratories and national epidemiological networks;
- stimulate improvement of AI expertise within the region, thereby improving the quality of disease diagnosis.

BOUBACAR M'BAYE SECK, FAO

Laboratory workshop at LNERV, July 2008, Dakar, Senegal

To achieve these results, the network coordinators considered the different stages of development among laboratories. The most advanced laboratories (those with better equipment and experienced staff) were called on to act as models/leaders for the others and to provide them with technical assistance and help. RESOLAB is technically assisted by IZSVe (Italy) and agencies such as the United States Department of Agriculture/Animal and Plant Health Inspection Service (USDA/APHIS) and the United States Centers for Disease Control and Prevention (CDC). So far, it has received funding from multiple donors (Canada, France, Sweden, the United Kingdom and the United States), but its consolidation and sustainability will depend on recognition of its capacity to contribute significantly to improvement of the diagnostic capacity of national veterinary laboratories, and on the support of member countries and their regional economic organizations.

Main outcomes of RESOLAB

- All laboratories in the region have completed questionnaires on their capacities, and shared results with the network; so far, 15 of the region's 23 laboratories have been technically assessed. The two nominated regional laboratories, in Dakar, Senegal, and Vom, Nigeria, were evaluated by a team of experts, and recommendations were made. In 2008, the first round of proficiency tests for AI and Newcastle disease (ND) testing was conducted in 12 countries in the

BOUBACAR M'BAYE SECK, FAO

RESOLAB Annual Coordination Meeting, December 2008, Bamako, Mali

region, under the umbrella of IZSVe and coordinated by FAO Headquarters. The results have been presented and discussed within the region, and the training programme has been adapted to take them into consideration.

- Since its launch, RESOLAB has coordinated training on AI testing for more than 70 laboratory technicians from the region's 23 countries; seven technicians from six countries have been trained in advanced AI diagnosis at IZSVe (Italy); a staff member of the National Veterinary Research Institute (Vom, Nigeria), the regional laboratory, attended a five-month study tour on influenza virus molecular diagnosis and sequencing at IZSVe; and *France Vétérinaire International* (FVI) experts organized on-site bench training missions at six national laboratories. Three quality assurance workshops are scheduled for the second semester of 2009, in collaboration with the Stamping Out Pandemic and Avian Influenza (STOP-AI) project and USDA/APHIS.
- A buffer stock of reagents for AI and ND molecular testing, and sample shipping boxes are stored at RESOLAB. Reagents for AI testing have been provided to all 23 laboratories in the region. Selected laboratories received reagents for molecular diagnosis, while the majority received necroscopy kits, sampling material, shipping boxes, serology (agar gel immunodiffision/haemagglutination inhibition [AGID/HI]) kits, personal protective equipment, and rapid antigen detection kits.
- The RESOLAB website includes a space for discussion, quarterly reports and special reports from members. Technical papers, with network members as contributing authors, have been published. Recommendations from the annual meetings held in 2007 and 2008 are also available on the website: www.fao-ectad-bamako.org/.

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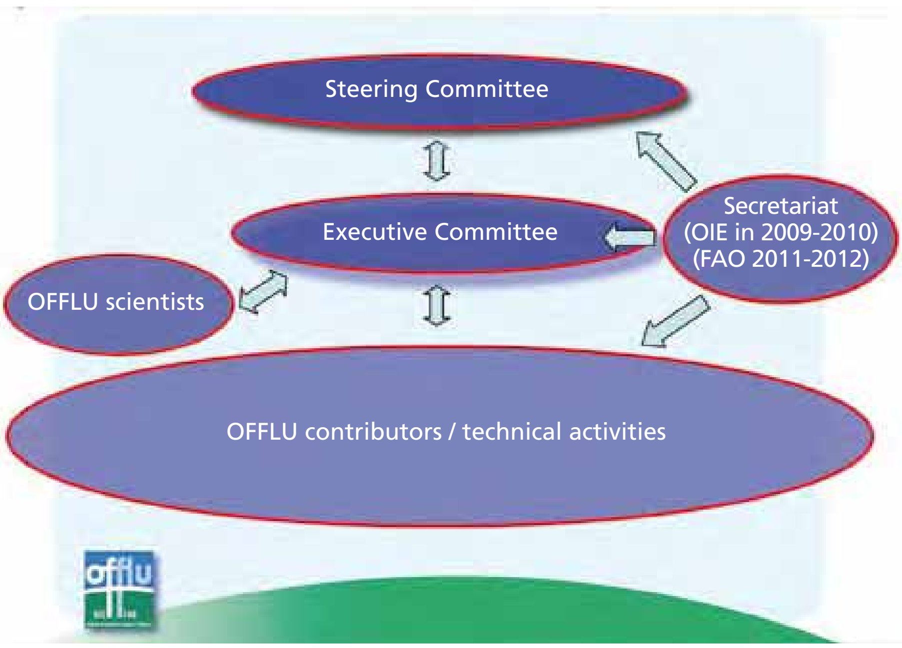
Progress in and around the Network of Reference Laboratories, Epidemiological Centres and Groups of Experts on Avian Influenza (OFFLU)

OFFLU is the joint World Organisation for Animal Health (OIE)/FAO Network of Expertise on Animal Influenza. Over the last two years, governance at OFFLU has been strengthened through changes in its structure; several OFFLU technical activities have been launched; closer work with the World Health Organization (WHO) has been included in important OFFLU administrative meetings, with WHO recognizing OFFLU as a key player; the joint system for a unified nomenclature for H5N1 avian influenza has been established; and informal but strong collaborative relationships have been established, allowing the flow of communication on topics of joint interest and the sharing of information; appropriate joint influenza sequence virus databases have been evaluated; and two poultry vaccine efficacy projects for H5N1 are being implemented in Indonesia and Egypt, which pioneer the use of antigenic cartography for H5 vaccine strain selection.

Structure of OFFLU



Recent OFFLU outcomes

Recently, the purpose, functionality and outputs of the OFFLU network have developed significantly. Recent notable achievements include:

- a raised profile and credibility on the international stage for OFFLU and its objectives, and greater global awareness of OFFLU (e.g. a reference to OFFLU in a *Nature* article/editorial of 16 and 18 June 2009);
- an expanded OFFLU network with a broader list of active scientific contributors whose wide-ranging expertise includes epidemiology, laboratory diagnostics, bio-informatics, biosafety, antigenic cartography and, more recently, swine influenza; there is also significantly greater representation of experts from the human health sector;
- a more effective working relationship with the WHO Global Influenza Programme (GIP), including many joint GIP/OFFLU meetings and projects; the exchange of information between the animal and human health sectors has been significantly improved, and mechanisms have been or are being formalized;
- a functional OFFLU Secretariat that provides support for technical meetings and activities, generates and distributes communications and guidance materials, and develops and maintains the website (www.offlu.net);
- eight OFFLU technical activities, run by small working groups of experts from the network, which currently cover: 1) evaluation of commercial diagnostic kits; 2) applied epidemiology; 3) biosafety; 4) vaccines and vaccination; 5) proficiency testing; 6-7) development of standardized reference materials for H5 sera and ribonucleic acid (RNA); and 8) the human-animal interface. All OIE/FAO international reference laboratories are represented in most of these groups, and experts from non-OIE/FAO reference laboratories have also been invited to become members (such as universities, national laboratories and field experts);
- technical guidance documents relating to diagnostics, surveillance and genetic sequence databases, produced by OFFLU in collaboration with its scientific contributors and the two OFFLU scientists, are posted on the OFFLU website;
- interactions with other disease networks (e.g. WHO-GIP, the European Union [EU] Avian Influenza Laboratory Network, the Foot-and-Mouth Disease Network, and the United States' National Animal Health Laboratory Network [NAHLN]), to share technical information, avoid duplication, discuss ideas for better networking, and develop information platforms;
- a clear OFFLU position on data sharing, using existing publicly available databases, with guidance on how to use these on the OFFLU website;
- a resolution on "Sharing of avian influenza viral material and information in support of global avian influenza prevention and control" adopted by all members of the OIE World Assembly of Delegates at the 76th OIE General Session in May 2008; OFFLU continues to encourage compliance with this resolution and is examining new incentives for the sharing of genetic sequences and associated data.

In addition, several OFFLU meetings and discussions have recently been held:

- meeting of the OFFLU applied epidemiology technical activity; OIE, Paris, 8 September 2008;
- OFFLU-Global Initiative on Sharing Avian Influenza Data (GISAID) meeting; Veterinary Laboratories Agency (VLA) Weybridge, United Kingdom, 24 July 2008;
- OFFLU Steering Committee meeting; FAO, Rome, 25 November 2008;*
- OFFLU Day at the 7th International Symposium on Avian Influenza; Athens, Georgia, United States, 8 April 2009;*
- OFFLU/WHO technical teleconference to discuss human-animal interface aspects of the novel A (H1N1) virus; 4 May 2009;*
- OFFLU teleconference on laboratory diagnosis of novel A (H1N1) in pigs; 14 May 2009;*
- OFFLU Steering Committee teleconference; 14 May 2009;*
- OFFLU/WHO teleconference on surveillance issues in novel influenza A (H1N1) and the human-animal interface; 21 May 2009;*
- OFFLU teleconference to develop an algorithm for the laboratory detection of A (H1N1) in pigs; 8 June 2009;
- OFFLU Steering Committee meeting; 14 September 2009;*
- OFFLU technical meeting for heads of AI institutes and swine influenza experts; 15 to 16 September 2009.*

OFFLU technical activities

These activities deliver clear answers to technical questions, guidance and recommendations.

Current technical activities are:

- compilation of an inventory of commercially available kits for diagnosing AI and – when manufacturers provide consent – a listing of this information;
- provision of expertise on animal influenza surveillance, phylogenetics, molecular epidemiology and identification of gaps/areas of duplication in global surveillance, through the applied epidemiology group;**
- development of minimum biosafety standards for handling AI viruses, particularly for developing countries; guidance on this is available on the OFFLU website and will be published in the forthcoming *OIE Manual for Diagnostic Tests and Vaccines for Terrestrial Animals;***
- providing veterinary authorities in Indonesia and Egypt with guidance on matching virus vaccine strains with circulating field strains using antigenic cartography technology;[1]

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* These meetings include(d) experts from the human health sector (WHO).

** These technical activities include experts from the human health sector (WHO).

[1] www.offlu.net/offlu%20site/projects/information%20offlu%20project5.pdf; and www.offlu.net/offlu%20site/egypt%20project.pdf.

- evaluation of ongoing proficiency testing and development of a set of common recommendations for proficiency testing;**
- development of an RNA standard for diagnostic testing;**
- development of standard H5 reference sera;
- establishment of a formal ongoing mechanism for information exchange at the human-animal interface** (described more fully in the following section).

Guidance has been published on the OFFLU website, including on minimum biosafety requirements for handling AI viruses in laboratories, which is aimed at developing countries

The technical activity groups have been communicating through face-to-face meetings (e.g. OFFLU epidemiology and vaccination groups), teleconferences, the FluLab-Net electronic communication forum, and e-mail. Guidance has been published on the OFFLU website, including on minimum biosafety requirements for handling AI viruses in laboratories, which is aimed at developing countries. Guidance will also be published in the OIE *Manual of Diagnostic Tests and Vaccines for Terrestrial Animals*.

At the OFFLU Day during the 7th International Symposium on Avian Influenza (held in Athens, Georgia, United States in April 2009), leaders of each technical activity provided an update on progress.[2] Some of the groups have already delivered results; others are expected to do so during 2009/2010. As an illustration, much variability was observed in procedures for proficiency testing, making harmonization virtually impossible. Antigenic cartography has be shown to be a useful tool in predicting antigenic matching between vaccine and field strains, which will still have to be confirmed by challenge testing. H5 and RNA standards will soon be ready for distribution to and assessment at OIE/FAO reference laboratories and, if they prove fit for the purpose, will be produced for broad distribution. Further updates from group leaders were provided at the OFFLU technical meeting (with representatives of each OIE and/or FAO reference institution) on 15 and 16 September 2009. Further technical activities will be identified by the experts, as needed.

The human-animal interface

Mechanisms for the coordination and collaboration of zoonotic influenza issues at the human-animal interface are being established. An FAO/OIE/WHO Joint Technical Consultation on Avian Influenza at the Human-Animal Interface was held from 7 to 9 October 2008 in Verona, Italy.[3] This meeting brought together top-level experts on influenza and other diseases from the animal and public health sectors to discuss priority virological and epidemiological issues, identify knowledge and technical gaps, and provide recommendations for further actions to address influenza and other emerging zoonotic diseases at the human-animal interface. Discussions emphasized that H5N1 is not the only animal influenza virus subtype posing an animal, zoonotic and pandemic threat, and that virological and epidemiological surveillance must be broadened to include other animal influenza viruses with zoonotic potential. A second technical consultation is being planned for spring 2010.

** These technical activities include experts from the human health sector (WHO).

[2] http://offlu.net/offlu%20site/ta_presentations.pdf.

[3] www.fao.org/avianflu/en/conferences/verona_2008.html.

In spring 2008, the OFFLU Steering Committee recommended that a technical activity be devoted to collaboration on influenza at the human-animal interface. Terms of Reference for this technical activity were developed and approved by WHO and OFFLU.[4] The objective of the group is *"to develop both general and specific mechanisms for improving coordination and technical communication about zoonotic/potentially pandemic animal influenza viruses between the animal and public health sectors, and to take steps to bridge cultural gaps between these sectors"*, and the proposed activities fall into three broad categories:

a) improving the coordinated assessment of influenza zoonotic/pandemic risks (overall and in emergencies) and bridging cultural gaps between the animal and human health sectors;
b) promoting research at the human-animal interface;
c) improving linkages among laboratory networks.

This technical activity therefore acts as an umbrella for the majority of OFFLU-WHO interface activities for influenza. A plan for the emergency sharing of information from the animal health sector that is relevant to public health is already being developed. Work to maintain global reference phylogenetic trees for H5N1 viruses, also listed as an activity under the terms of reference, is ongoing, with updates posted on the WHO and OFFLU websites.[5] In conjunction with OFFLU, WHO is preparing a global research agenda that includes a human-animal interface stream.

Another activity under the same terms of reference is the development of a calendar of upcoming scientific discussions in each sector, to ensure cross-sectoral participation. To date, WHO routinely participates in all relevant OFFLU events (especially OFFLU Steering Committees and meetings of reference laboratories), and invitations for OFFLU participation in WHO meetings have included:

- WHO Polymerase Chain Reaction (PCR) Working Group; Geneva, 1 May 2009;
- WHO Consultation on the Composition of Influenza Vaccine for the Northern Hemisphere 2009 to 2010; Geneva, 8 to 11 February 2009;
- WHO Regional Office for Africa (AFRO) National Influenza Centre (NIC) meeting; Yaoundé, Cameroon, 29 June 2009;
- WHO Consultation on the Composition of Influenza Vaccine for the Southern Hemisphere; Melbourne, Australia, 21 to 23 September 2009.

National capacity building

OFFLU also contributes to targeted national capacity building for virological diagnosis and virological/epidemiological surveillance of influenza viruses of veterinary importance. Throughout much of 2009, an FAO/OFFLU scientist has been working technically at the country level addressing specific issues of concern in the animal health sector and increasing capacity in certain countries. Emergency laboratory assistance was provided as part of Crisis Management Centre (CMC) missions in response to H5N1 and its emergence in Nepal (February 2009) and Mexico (May 2009), and an

[4] Available on request from Elizabeth Mumford, mumforde@who.int.
[5] www.who.int/csr/disease/avian_influenza/guidelines/nomenclature/en/index.html.

OFFLU vaccine efficacy project implemented in Indonesia included project advocacy within the Ministry of Agriculture, laboratory training for Indonesian laboratories, procurement of supplies and equipment, and coordination of introductory workshops on molecular and antigenic analysis for more than 35 Indonesian scientists. These projects have been technically enhanced by collaboration with laboratory project partners in Australia, the Netherlands and the United States, including through cooperative review and analysis of project data on antigenic and genetic virus characterization.

The OFFLU vaccination group has been a useful resource for providing field-level personnel with additional expertise, and OFFLU has been able to include additional vaccination experts in technical discussions, especially on H5N1 vaccination of poultry in Indonesia. Teleconferences and meetings have been held to share technical inputs regarding vaccination of one-day-old chicks and broilers, results on new candidate vaccines, and vaccination strategies in Indonesia, and OFFLU has been providing technical advice to Indonesia on the selection of vaccine strains/types against circulating field viruses. A meeting on vaccination strategy was held in Jakarta on 14 November 2008, resulting in an update of the recommendations for vaccination strategy in Indonesia.

A similar national project on H5N1 poultry vaccine efficacy has now been initiated in Egypt. The first technical meeting on vaccine efficacy in Egypt is scheduled for 30 September to 1 October 2009. A private vaccine manufacturer and two international laboratories have requested FAO/OFFLU to act as a neutral technical platform for presentation and discussion of confidential results.

Finally, to increase direct laboratory support to countries, the two OFFLU officers in FAO, working with CMC-Animal Health, have prepared a list of critical reagents and laboratory items for diagnosis of African swine fever, peste des petits ruminants and Rift Valley fever, as well as animal influenza. At FAO's request, a selection of laboratory items from pre-selected providers can be provided within a few days to any country requesting such assistance.

MIA KIM, FAO

A medical doctor setting up a public information area on H1N1, Mexico City

OFFLU and the pandemic influenza H1N1 2009

When H1N1 was first reported in 2009, OFFLU, WHO-GIP, the Emergency Prevention System for Transboundary Animal and Plant Pests and Diseases (EMPRES) and CMC-Animal Health were prepared and able to respond jointly to the human-animal interface issues associated with the new H1N1 event. By May 2009, the collaborative relationships among FAO, OIE and WHO were sufficiently well established to be mobilized within hours for the discussion and sharing of available information. The OFFLU network was already strong and flexible enough to expand within a matter of days to include swine expertise,[6] and changed its scope and name to the OIE-FAO Network of Expertise on Animal Influenza.

[6] www.offlu.net/offlu%20site/offlu-29apr.pdf.

OFFLU and WHO gathered international experts for a first WHO/OFFLU teleconference on H1N1 at the human-animal interface on 4 May 2009.[7] Subsequent teleconferences on diagnostics,[8] surveillance[9] and diagnostic testing algorithms for the emergent virus in the animal health sector[10] were held on 14 May, 21 May and 13 June, respectively. Reports from these discussions are available on the OFFLU website (see footnotes 7 to 10), along with a variety of documents that were produced to assist animal health laboratories with identification of the emergent virus: a list of laboratories for international shipment of H1N1-suspicious samples/isolates, and guidance on the shipment of suspicious samples, an algorithm for laboratory detection, guidance on sampling pigs for influenza diagnostic tests, etc. The OFFLU network had also become established and respected enough to be asked by WHO to represent the animal health sector (in conjunction with OIE and FAO) in addressing two specific questions – the name of the virus, and specific issues regarding its origin – in high-level WHO teleconferences. The strength and flexibility of OFFLU, its effective collaboration with both inter- and intrasectoral partners, and its ability to respond rapidly all suggest that this network will contribute significantly to the scientific community well into the future.

MIA KIM, FAO

A vendor wearing a mask setting up his stall during the imposition of social distancing measures, Mexico City

A secondary benefit of these discussions was increased communication about swine influenza viruses in general among public and animal health experts and those new to the field. The Chairperson of OFFLU was interviewed by the journal *Nature*, whose editorial in the 18 June 2009 issue (Volume 459, Issue 7249) stated: *"OFFLU has also been outspoken on the need for countries to share virus samples and sequences for research (see* Nature, *440: 255–256; 2009) and has built important bridges with the World Health Organization (WHO) and other public-health agencies. What is needed now is international support for a greatly expanded OFFLU-like network that has enough funding to do its own research and to coordinate global surveillance efforts on influenza and other diseases emerging from animals."*

CORTNEY PRICE, FAO

The CMC-AH team discusses response strategies for pandemic H1N1 2009 during a daily action planning meeting, Rome, Italy

Gaps in available information on swine influenza viruses were immediately noted during the joint discussions on origin, composition and other characteristics of the

[7] www.offlu.net/offlu%20site/who_offlu2009_05_15.pdf.

[8] www.offlu.net/offlu%20site/telecon_minutes_14-05-09.pdf.

[9] www.offlu.net/offlu%20site/survofflu_final.pdf.

[10] http://offlu.net/offlu%20site/offlu_siv_surveillance_testing_algorithm.pdf.

pandemic H1N1 2009 virus. Recognition of the information gaps resulted in further discussions on virological surveillance and information sharing. It was noted that scientists posted additional swine influenza virus sequences (about 150) on GenBank[11] and/or GISAID[12] in the weeks after these discussions were initiated.

OFFLU will keep updates of validated protocols and primers and probes and will share this information widely with national laboratories through regional laboratory networks.

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[11] www.ncbi.nlm.nih.gov/.

[12] http://platform.gisaid.org/dante-cms/live/struktur.jdante?aid=1131.

Meetings

Scientific Consultation on Potential Risks of Pandemic H1N1 2009 Influenza Virus at the Human-Animal Interface: report of a teleconference, 3 June 2009

Background

Global transmission of the pandemic influenza A (H1N1) 2009 virus[1] continues to occur through person-to-person contact. Joint statements have been made by the World Health Organization (WHO), the Food and Agriculture Organization of the United Nations (FAO) and the World Organisation for Animal Health (OIE) about the safety of pork and pork products. Some questions may remain, however, about the potential risk to human health from contact with pigs potentially infected with this virus and their products, from primary production to consumer. At the time of the consultation, the pandemic H1N1 2009 virus had been confirmed in one swine herd in Canada.[2] Although food safety issues are not normally raised on a global level when human infections with what appears to be a swine influenza virus occur, given the current public health context it is essential to base ongoing decisions on the most current and accurate science available.

Objectives

The purpose of the scientific consultation was to answer questions using the existing science on influenza viruses infecting pigs, and to identify knowledge gaps associated with the risk of exposure (and subsequent clinical illness) to the pandemic H1N1 2009 influenza virus at the human-animal interface. Answers were sought to a list of questions on risks from direct contact, the environment and along the food chain, as well as the risk of humans transmitting virus to pigs. The questions were answered using available data on pandemic H1N1 2009 virus, extrapolation from data on other influenza viruses that affect swine, and expert opinion. In addition, the experts identified the data/research needs that are most critical to these issues and that need to be addressed as a matter of priority.

Areas of discussion

I) Risks from direct contact

What is the nature and level of risk to people working with live pigs?

Swine influenza viruses, including H1N1 and certain other influenza subtypes, can circulate endemically in swine herds. Sporadic human infections, with or without clinical signs, have been reported from some countries, with occasional virological confirmation and clear serologic evidence of human exposure to these viruses (Olsen

Swine influenza viruses, including H1N1 and certain other influenza subtypes, can circulate endemically in swine herds

[1] Termed "pandemic H1N1 2009" at the time of writing.

[2] This was the case at the time of the consultation. Since then, however, there have been other instances of swine herds being affected in other countries, presumably from viral transmission between humans and livestock, including poultry.

Methane cover of the first effluent-treatment lagoon. 9 May 2009, Perote, Veracruz, Mexico

et al., 2002). Influenza surveillance in humans, even when extensive, captures only a small proportion of all influenza infections, with a minimal amount at the human-animal interface.

According to a number of published studies of occupational exposure, evidence of human infection with swine influenza viruses among those working with pigs in the United States is not uncommon (Olsen *et al.*, 2002; Ramirez *et al.,* 2006; Myers *et al.,* 2006; Myers, Olsen and Gray, 2007; Gray *et al.,* 2007; Gray and Baker, 2007; Gray, Trampel and Roth, 2007; Gray and Kayali, 2009). Limited data are available from other countries. Among workers in the United States with direct exposure to pigs, one study found sero-prevalence was highest among farmers, followed by veterinarians and then slaughterhouse workers (Myers *et al.,* 2006). A number of studies (Olsen *et al.,* 2002; Myers *et al.,* 2006; Gray *et al.,* 2007) found an increased sero-prevalence in circulating swine influenza viruses in farmers compared with urban controls. A serological study of the spouses of swine workers in the United States, without reported direct exposure to pigs themselves, also showed evidence of possible viral transmission from the workers to their spouses. The specific exposure remained unclear, but may have been direct human-to-human transmission or fomite transmission (Gray *et al.,* 2007).

Evidence shows that influenza virus infections in pigs are respiratory in nature and not systemic. It was reported that virus shedding occurs via nasal secretions and coughing during the time when the animal is acutely ill with fever and lethargy. The approximate time frame for shedding has been reported as two days after infection, continuing for four to seven days (Richt *et al.,* 2006; Vincent *et al.,* 2007). Virus has not been demonstrated to be shed through the faeces. It was discussed that co-morbidities and other conditions, which may exist more frequently in the field, may exacerbate the clinical picture in infected animals.

Virus can circulate among pigs throughout the year. Although there is a seasonal pattern to influenza in pigs, the disease is not restricted to the cold season for pigs living in closed systems.

Based on an outbreak on a swine farm in Canada where the pandemic H1N1 2009 virus has been detected (OIE World Animal Health Information Database, no date C) and from recent studies,[3] the clinical picture for infection with pandemic H1N1 2009 virus in pigs is similar to that for other swine influenza viruses.

What is the nature and level of risk to those involved in slaughtering and butchering/processing?

Slaughterhouse workers may be at lower risk than farmers and veterinarians, according to an occupational study conducted in the United States (Myers *et al.,* 2006). As viraemia in pigs is presumed to be very rare and pigs are not thought to shed virus in faeces,

[3] Personal communication, 3 June 2009 Teleconference.

risk of human exposure is believed to come from handling the respiratory tissues only, not the meat or blood. It is always recommended that only healthy animals are allowed into the food chain, after appropriate ante-mortem and port-mortem inspections.

What is the effect of vaccination on these risks?

The evidence would suggest that appropriately vaccinated pigs are less likely to become clinically ill and also less likely to shed viruses. The same is believed to be true for maternal immunity, which lasts approximately ten weeks.

It was reported that some commercial swine vaccines have not had good efficacy and, therefore, autogenous vaccines are frequently used in the United States.

Consensus statement on risks from direct contact

Humans in direct contact with pigs infected with swine influenza viruses can become infected and can develop influenza-like illness (ILI). Since the virus is shed through nasal secretions of clinically ill pigs, exposure is commonly through aerosols or droplets but is negligible through contact with faeces. The true frequency of human infections resulting from contact with swine is not known. Appropriately vaccinated swine herds are thought to pose less of a public heath risk than unvaccinated herds.

Appropriately vaccinated swine herds are thought to pose less of a public heath risk than unvaccinated herds

To date, there is no information available to suggest that the pandemic H1N1 2009 virus is currently circulating in pigs.

II) Risks in the environment

What scientific evidence is available regarding the presence and persistence of viable influenza viruses, especially influenza viruses that infect swine, in manure, in the farm environment and on surfaces/fomites?

Little specific work has been done on the persistence of swine influenza viruses in the environment, but it would be expected to be similar to that of other influenza viruses. It was agreed that influenza viruses generally persist longer in cold areas. It has been reported under experimental conditions that virus survives in small-particle aerosols (Brankston *et al.,* 2007).

It was suggested that owing to the negligible faecal shedding of swine influenza viruses, minimal risk was posed by manure from infected herds. The difference between conditions in confinement operations and those in backyard or village pig raising situations, in terms of the ability to clean the housing units, was noted. However, given that faecal shedding is not considered to be a major factor, it is believed that swine influenza viruses may be maintained in herds by naive pigs introduced to the population. It is assumed that the pandemic H1N1 2009 virus will enter the pigs and circulate among them, as other swine influenza viruses do.

Consensus statement regarding risk in the environment

The risk of exposure to pandemic H1N1 2009 virus from environmental sources, such as contaminated fomites and manure, is probably minimal, especially from pigs raised under confinement conditions.

III) Risks along the food chain

What evidence is available regarding the survival of influenza viruses on meat surfaces?

The risk of cross-contamination from respiratory secretions, or from contact with respiratory organs/tissues, to the meat during slaughter and processing is very low. If it occurred, virus would be present in low concentrations. As the highest concentration of virus would be in the lungs and respiratory tissue, and not in the intestinal tract, contamination of the meat surface would be less likely. It was noted that there are no data on concentrations or survival of swine influenza viruses on meat.

If evidence were to support the presence of influenza virus in raw meat, what evidence is available regarding the presence and concentrations of influenza viruses in raw meat or other by-products of swine infected with influenza viruses?

There is very little evidence of the virus being present in raw meat. If this did occur, the virus titres would probably be very low. Previous studies have found only a very minimal amount of virus in muscle (Romijn, 1989; AFFA 2001), which would be readily destroyed by cooking, provided the temperature reaches 70 °C. An Australian assessment found the risk of importing swine influenza infection in meat was low (Williams, 2003).

What evidence is available regarding the survival of influenza viruses in cured/dried/otherwise preserved pork or pork products?

It was noted that it is difficult to make general statements regarding cured/dried/otherwise preserved pork or pork products owing to the many variations in food preparation and processing techniques. However, many of these products are tested and it has been shown that, in general, most processing methods can inactivate a variety of pathogens, many of which are less labile than influenza.

What evidence is available regarding potential human infection through ingestion of influenza virus (dose response)?

There are no documented cases of human infection with swine influenza virus via ingestion

There are no documented cases of human infection with swine influenza virus via ingestion. It was mentioned that, if ingestion were a viable route of influenza transmission, cases of human infection with highly pathogenic avian influenza (HPAI) H5N1 associated with consumption would have been expected to be more routinely reported, especially as poultry develop systemic infections, virus is found in the meat, and the birds are often slaughtered in home settings.

In animal studies of ferrets fed meat contaminated with HPAI virus, the animals became infected via the respiratory or digestive tracts, depending on the virus strain (Lipatov *et al.,* 2009). In other studies and according to the literature, a three log higher virus dose was required to infect chickens or ferrets via ingestion of infected meat versus inhalation.[4] The oral route is not the natural route of infection.

[4] D. Swayne, unpublished data.

Consensus statement regarding risk along the food chain

Available evidence suggests the risk of infection with swine influenza viruses from pork consumption is negligible. Ingestion is not the normal route of infection, and the virus is readily destroyed by cooking at 70 °C. The combination of multiple risk-reduction variables act together to decrease the risk to insignificant under most conditions. These variables include: respiratory infection; short-lived infections; short-lived viraemia or organ contamination; lack of faecal shedding (resulting in low cross-contamination potential during slaughter and preparation); cooking of pork at proper temperatures; and higher doses of contaminants/viruses required for infection via the gastrointestinal tract.

IV) Risks to swine from humans

What evidence is available regarding the probability of infected humans in contact with swine transmitting the infection to pigs?

In the past, there were several documented examples of influenza viruses, including H1N1 and H3N2, moving from humans into pigs. In some instances, the virus has remained stable and spread to other swine herds, while in others it seems to have died out. It was noted that among viruses studied in the United States, the genetic make-up of these viruses provides them with greater ability to adapt and change, and they are becoming more promiscuous. With respect to the occurrence of H5N1 avian influenza virus, for the last ten years in China, Hong Kong Special Administrative Region (Hong Kong SAR) and elsewhere, surveillance has rarely identified H5N1 in pigs.

Evidence of the pandemic H1N1 2009 virus moving to swine is a seemingly rare event as only one occurrence has been reported to date (OIE World Animal Health Information Database, no date C).[5] As it is known that this is possible, there is need to know when it actually occurs. There is currently very little surveillance that would allow rapid detection of viruses crossing between humans and pigs (or other susceptible animals).

MOISES VARGAS, FAO

Each shed houses an average of 960 fattening pigs, 9 May 2009,Perote, Veracruz, Mexico

Consensus statement regarding risks to swine from humans

We can expect pandemic H1N1 2009 virus to move from humans to pigs. There was consensus that further surveillance is needed to improve understanding of what viruses are circulating in pigs and other animals, but the design, implementation and funding sources for this surveillance are important issues requiring further discussion.

[5] See footnote 2. At the time of the consultation, only one occurrence of transmission to pigs was known (Canada). Since then evidence has emerged of the pandemic H1N1 2009 in swine in two other countries (OIE World Animal Health Information Database, no date A; no date B) and in turkeys (OIE World Animal Health Information Database, no date D) in a third.

Proposed future actions for consideration

- Discuss mechanisms, logistics and funding sources for improved surveillance in animals, not just pigs.
- Discuss mechanisms, logistics and funding sources, and outline the goals of prospective sampling in swine facilities.
- Surveillance for ILI in pig farm workers.
- Persistence of the virus on fomites.

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More information available at: www.fao.org/ag/againfo/programmes/en/empres/ah1n1/background.html

News

AKIKO KAMATA, FAO

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Farewell to Joseph Domenech

Samuel Jutzi, Director of the FAO Animal Health and Production Division, joined colleagues and friends in wishing Dr Joseph Domenech well in his future engagements back with the Ministry of Agriculture in France. The Director's thank you message was delivered during a farewell party organized in Dr Domenech's honour. He will retire from FAO as Chief of the Animal Health Service, FAO Chief Veterinary Officer in September 2009.

The arrival at FAO, Rome of Dr Joseph Domenech - Jémi to his staff on the working floor - coincided with the start of the rapid spread of H5N1 highly pathogenic avian influenza (HPAI) in Asia. The first epizootic wave peaked in January and February 2004 and took the affected countries by surprise, so veterinary services were ill-prepared. Significantly, there was no international strategy for concerted efforts against this zoonotic disease agent. The transboundary nature of the problem became progressively more prominent, and in spring 2005 H5N1 virus started to spread into the temperate climate zone of Eurasia. Early in 2006, the virus also showed up in the Near East and parts of Africa. The United Nations - including FAO, the World Health Organization (WHO), the World Bank, the United Nations Children's Fund (UNICEF) and the United Nations System Infuenza Coordinator (UNSIC) - together with the World Organisation for Animal Health (OIE) united as a force to deal with the global-scale ramifications of this major threat at the animal-human health interface. Jémi Domenech took centre stage in these deliberations, and became a strong voice in directing international efforts. Through his involvement, there was a shift in the primary focus of responses to the pandemic risk, away from human vaccines and antiviral preparedness towards addressing H5N1 circulation in poultry. Fighting the disease at its source in poultry in the worst-affected developing countries rightly became the priority for technical and finance assistance agencies alike. At the height of the panzootic, more than 60 countries had become infected. Thanks to FAO, OIE, WHO, UNICEF, the World Bank, UNSIC and many other partners, H5N1 has now been contained and persists in only five countries. While the fight continues, this first battle was won in no small part thanks to the relentless efforts of Jémi Domenech.

A brief profile of Dr Joseph Domenech

Dr Joseph Domenech was born in France. As Chief of the Animal Health Service and FAO Chief Veterinary Officer he has been responsible for managing the team working on animal health – transboundary animal diseases, veterinary public health, and vector-borne and parasitic diseases – with programmes related to normative activities, expertise, design and implementation of field projects, and coordination of worldwide programmes (rinderpest eradication, H5N1 highly pathogenic avian influenza [HPAI]) and regional programmes (overseeing the Secretariat of the European Commission for the Control of Foot-and-Mouth Disease [EUFMD] and the Programme Against African Trypanosomiasis [PAAT]) hosted at FAO.

From 2004 to 2007, an important part of his time was devoted to setting up and coordinating FAO's response to the avian influenza (AI) crisis in Asia and other regions at risk. This programme had a budget of more than US$200 million, and involved about 200 people working in more than 50 countries, regional centres and FAO Headquarters in Rome.

Prior to his assignment to FAO, from 1992 to 2003, Dr Joseph Domenech worked for the International Cooperation Centre of Agricultural Research for Development (CIRAD), based in Montpellier, France, where he was the Director of the Animal Production and Veterinary Medicine Department (CIRAD-EMVT). From 1996 to 1997 he worked for the *Centre National d'Etudes Vétérinaires et Alimentaires* (CNEVA), Maisons-Alfort, France, where he was the delegate for international, European and business activities. From 1992 to 1996 he worked for the Organization of African Unity (now the African Union [AU]) Interafrican Bureau for Animal Resources (OAU-IBAR), Nairobi, where he was Technical Advisor of the OAU-IBAR Director for implementation of the Pan African Rinderpest Campaign (PARC). From 1986 to 1992 he worked for the Central Veterinary Laboratory, Bingerville, Côte d'Ivoire, where he was Chief Technical Advisor to the director of the laboratory, Chief of the Diagnosis and Research Service, and Chief of a French-funded project to support the laboratory. From 1980 to 1986, he was Director of the *Laboratoire de Diagnostic et de Recherches Vétérinaires de Port-Laguerre,* Nouméa, New Caledonia. From 1976 to 1980, he was Chief of the Bacteriology Vaccine Production Service and Bacteriology Diagnostic Service, *Laboratoire de Recherches Zootechniques et Vétérinaires de Farcha*, N'Djamena, Chad. From 1972 to 1976 he was Chief of the Bacteriology Vaccine Production Service of the National Veterinary Institute, Debre-Zeit, Ethiopia.

Dr Domenech holds a doctorate in veterinary medicine, from the *Université Paul Sabatié*, *Faculté de Médecine*, Toulouse, France, a Ph.D. from the *Université Paris XII*, Créteil, France and specialized degrees in bacteriology, virology, immunology and epidemiology. He had undertaken more than 200 missions in Africa, Asia, the Americas and the Near East as an expert in laboratory diagnostics, vaccine production, infectious diseases, epidemiology, control programmes and the organization of animal health systems.

Meetings and publications

Upcoming meetings and events

- First Meeting of the Permanent Joint Committee of the Mediterranean Animal Health Network (MAHN or REMESA), Tunis, Tunisia, 15 to 16 July 2009.
- Regional training on Rift Valley fever (RVF) epidemiology and diagnosis, Algiers, Algeria, 18 to 22 July 2009. Veterinary Laboratories Agency (VLA).
- International Conference – Animal Diseases 2009, University of London, Surrey, United Kingdom, 2 to 4 September 2009. www.defra.gov.uk/vla/news/new_conf_vla2009.htm.
- XVI Congress of the World Veterinary Poultry Association, Marrakesch, Morocco, 22 to 26 September 2009. www.wvpa.net./fs_wvpa_congress.html.
- Closed Session of the European Commission for the Control of Foot-and-Mouth Disease (EUFMD) Research Group, Slovenia, 23 to 25 September 2009.

- Meeting on Control of FMD and other Exotic Diseases in the Southern Balkans, Istanbul, Turkey, 5 October 2009.
- Annual tripartite meeting of GTFS/INT/907/ITA, Istanbul, Turkey, 5 to 6 October 2009.
- EUFMD Executive Committee, Istanbul, Turkey, 6 to 7 October 2009.
- Regional Meeting on the Progressive Control of FMD in West Eurasia, co-organized by EUFMD and EMPRES GTFS/INT/907/ITA, Istanbul, Turkey, 7 to 9 October 2009.
- Annual Meeting of the FAO/OIE FMD Reference Laboratory Network, New Delhi, India, 19 to 22 October 2009.

FAO Animal Production and Health publications

- **FAO Animal Production and Health Manual No. 7:** *Sistema AVE de información geográfica para la asistencia en la vigilancia epidemiológica de la influenza aviar, basado en el riesco* (available at www.fao.org/docrep/012/i0943s/i0943s00.htm and ftp://ftp.fao.org/docrep/fao/012/i0943s/i0943s00.pdf).
- **FAO Animal Production and Health Guidelines No. 1:** *Collection of entomological baseline data for tsetse area-wide integrated oest management programmes* (available at www.fao.org/docrep/011/i0535e/i0535e00.htm and ftp://ftp.fao.org/docrep/fao/011/i0535e/i0535e.pdf).
- **FAO Animal Production and Health Paper No. 166:** *Intercambio comercial de aves silvestres vivas (y otros desplazamientos afines) en 33 paises de America Latina y el Caribe* (available at www.fao.org/docrep/011/i0708s/i0708s00.htm and ftp://ftp.fao.org/docrep/fao/011/i0708s/i0708s00.pdf).

New staff

Christopher Hamilton

Christopher Hamilton-West (DVM, M.Sc.) joined the Emergency Prevention System for Transboundary Animal and Plant Pests and Diseases Global Early Warning System (EMPRES/GLEWS) group in March 2009, as veterinary epidemiologist working on temporal and spatial analysis of animal diseases. Having graduated in veterinary science from the University of Chile, Santiago in 2004, in 2005 he worked as a consultant in projects for the Chilean Veterinary Services on harmonization of sanitary measures between Chile and the European Union. In 2006, on finishing an M.Sc. on preventive veterinary medicine (University of Chile), he worked as a consultant for the National Fishery Service in Chile during the infectious salmon anaemia crisis, and for the National Secretary of Fisheries on development of new animal health standards for Chilean aquaculture. Currently, he is completing his Ph.D. studies in veterinary epidemiology at the University of Chile, finishing his thesis on the development of strategies on prevention and control of HPAI in backyard poultry in Chile.

Contributions from FAO Reference Centres

FAO/OIE World Reference Laboratory for FMD, Pirbright, United Kingdom

Report from FAO World Reference Laboratory for FMD, January to June 2009

Country	No. of samples	Virus isolation in cell culture/ELISA[1]									RT-PCR[5] for FMD (or SVD) virus (where appropriate)		
		FMD[2] virus serotypes							SVD[3] virus	NVD[4]			
		O	A	C	SAT 1	SAT 2	SAT 3	Asia 1			Positive	Negative	Not tested
Bahrain	9		3					2		4	7	2	
Botswana	4	-	-	-	-	4	-	-	-	-	4	-	-
Cambodia	4	3	1	-	-	-	-	-	-	-	4	-	-
China (Hong Kong SAR)	13	12	-	-	-	-	-	-	-	1	12	1	-
China (Taiwan Province of China)	1	1	-	-	-	-	-	-	-	-	1	-	-
Egypt*	41	27	11	-	-	-	-	-	-	5	39	2	-
Ethiopia	47	21								24	31	16	-
Iraq	25	-	11	-	-	-	-	-	-	14	15	10	-
Islamic Republic of Iran	45	10	33	-	-	-	-	-	-	2	44	1	-
Israel	60	26	18	-	-	-	-	-	-	16	41	7	
Italy**	32	-	-	-	-	-	-	-	32	-	-	-	32
Kenya***	44	6	2	-	14	6	-	-	-	17	39	5	-
Kuwait	6	-	6	-	-	-	-	-	-	-	6	-	-
Lebanon	7	-	4	-	-	-	-	-	-	3	5	2	-
Libyan Arab Jamahiriya	117	-	37	-	-	-	-	-	-	80	34	81	
Myanmar	7	5	-	-	-	-	-	-	-	2	7	-	-
Nepal	27	12	-	-	-	-	-	-	-	15	22	5	-
Pakistan	29	1	17	-	-	-	-	-	-	9	25	4	-
Senegal	29	-	-	-	-	-	-	-	-	29	3	26	-
Somalia	4	-	-	-	-	-	-	-	-	4	-	4	-
Sudan	8	5	-	-	-	2	-	-	-	1	7	1	
Thailand	22	10	12	-	-	-	-	-	-	-	22	-	-
Turkey	14	9	4	-	-	-	-	-	-	1	3	-	11
Uganda	3	-	-	-	-	-	-	-	-	3	2	1	
United Arab Emirates	22	9	-	-	-	-	-	-	-	13	16	6	-
West Bank and Gaza Strip	34	20	5	-	-	-	-	-	-	9	30	4	-
Yemen	74	38	-	-	-	-	-	-	-	36	52	22	-
Zambia	16	-	-	-	6	4	-	-	-	6	14	2	-
Total	**744**	**215**	**164**		**20**	**16**		**4**	**32**	**294**	**485**	**202**	**57**

[1] FMD (or SVD) virus serotype identified following virus isolation in cell culture and antigen detection ELISA.
[2] Foot-and-mouth disease.
[3] Swine vesicular disease.
[4] No FMD, SVD or vesicular stomatitis virus detected.
[5] Reverse transcription polymerase chain reaction for FMD (or SVD) viral genome.
*Two samples from Egypt contained a mixture of types O and A FMDVs.
**Samples from Italy submitted for SVDV characterization.
***One sample from Kenya contained a mixture of types O and SAT 1 FMDVs.

FAO/OIE Reference Laboratory for Rinderpest and Peste des Petits Ruminants, Montpellier, France

Report from FAO Regional Reference Laboratory for PPR, International Cooperation Centre of Agricultural Research for Development (CIRAD), Montpellier, France, January to June 2009

Country	Species	Sample	Number of samples	Number of PPR-positives/doubtful	Test	Nature of the test Confirmatory or tentative
RPV[1]/PPRV[2]						
Sudan	Caprine/camel	Tissue/tissue culture harvest	88	63/2	RT-PCR[3] QRT-PCR[4] sequencing	Confirmatory
Vaccine contaminants						
Jordan	-	PPR vaccine	1	-	Quality control [5]	Pass
Spain	-	BTV[6] vaccine	5	-	Quality control [5]	Pass

[1] Rinderpest virus.
[2] Peste des petits ruminants virus.
[3] Reverse transcriptase-polymerase chain reaction.
[4] Quantitative reverse transcriptase-polymerase chain reaction.
[5] Sterility test + PCR (RPV, PPRV, bovine viral diarrhoea [BVD] virus, mycoplasma) + titration (cytopathic effect [CPE]) visualized by immunoflorescence test using an anti-PPR monoclonal antibody (anti-PPRV Mab) + sequencing.
[6] Bluetongue virus.

Stop the press

Information presented in this bulletin concerns animal disease information up to July 2009. From July 2009 to October 2009, there have been reports of more transboundary animal diseases (TADs) across the world.[1]

Pandemic H1N1 2009 was reported in Argentina (July 2009), Australia (July 2009), Ireland and the United Kingdom (September 2009), and Norway and the United States (October 2009) in pigs showing mild clinical signs, except for in Norway, where the pigs only tested positive for the disease. The disease was also reported in Chile (August 2009) in turkeys that showed mild clinical signs.

For more information see: www.fao.org/ag/againfo/programmes/en/empres/ah1n1/background.html

Highly pathogenic avian influenza (HPAI) subtype H5N1 was reported in Bangladesh (September 2009). H5N1 Avian influenza infection was reported in wild birds in Mongolia (August 2009 in Anser indicus, Tadorna ferruginea and Bucephala clangula). H5N1 HPAI continues to be reported in Egypt and Indonesia in domestic poultry. The HPAI subtype H7N7 was reported in Spain (October 2009).

Low pathogenic avian influenza virus (LPAI) subtype H5 was reported in Spain (June 2009). H7N9 LPAI was reported in the United States (August 2009).

Foot-and-mouth disease (FMD) serotype SAT 1 was reported in South Africa (September 2009). FMD serotype O was reported in China (September 2009) and Colombia (August 2009). In Egypt (August 2009), a total of five outbreaks of type O was reported in May/June 2009 in Fayyum, Dumyat, Ash Sharqiyah, Al Jizah and Al Gharbiyah Governorates. FMD is rarely reported from Egypt; the last reported case was in January 2008.

African swine fever (ASF) was reported in the Russian Federation (September to October 2009) in the area between the Black Sea and the Caspian Sea.

Classical swine fever (CSF) was reported in Bulgaria (September to October 2009) and Lithuania (July 2009), and a wild boar tested positive in the Russian Federation (July 2009).

Rift Valley fever (RVF) outbreaks continue to occur on the eastern side of South Africa; outbreaks in Kwazulu-Natal (April to June 2009) and Mpumalanga (May 2009) were reported to OIE.

Bluetongue (serotypes 1, 8 and 24) continues to be reported in the Mediterranean area and Europe. Serotype 1 was reported in Portugal (July 2009), Algeria and Morocco (September 2009) and Greece (September 2009). Serotype 8 outbreaks occurred in northern Israel (July 2009) and Italy (September 2009). A serotype 24 outbreak occurred in Israel (May 2009). An outbreak of bluetongue was also confirmed in West Bank and Gaza Strip[2] (September 2009).

Brucellosis was reported in Croatia (*B. melitensis*, July 2009), Switzerland (*B. suis*, September 2009), Bulgaria (*Brucellosis melitensis*, October 2009) and Germany (*B. suis*, June 2009).

Rabies was reported in Finland for the first time in a bat (*Myotis daubentoni*, August 2009). The last outbreak of rabies in Finland was in November 2007, in imported dogs, after 18 years absence of the disease. Rabies continues to be reported in Bali, Indonesia (October 2009, in dogs) and in northern Italy (July to October 2009, in one dog and 13 foxes).

[1] More information available at the OIE–WAHID website: www.oie.int/wahid-prod/public.php?page=home.

[2] Serotype not yet identified.

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