FIFTH REPORT

January 2011–January 2012

GLOBAL PROGRAMME FOR THE PREVENTION AND CONTROL OF HIGHLY PATHOGENIC AVIAN INFLUENZA

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GLOBAL PROGRAMME FOR THE PREVENTION AND CONTROL OF HIGHLY PATHOGENIC AVIAN INFLUENZA

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
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Foreword

The Food and Agriculture Organization of the United Nations's (FAO) response to the H5N1 strain of highly pathogenic avian influenza (HPAI) emergency, which began in January 2004, demonstrated global leadership, regional cooperation and national action. FAO and the World Organisation for Animal Health (OIE) took the lead role in coordinating international response to HPAI control at the animal source. In consultation with the World Health Organization (WHO), FAO and OIE developed The Global Strategy for Prevention and Control of H5N1 HPAI in 2005.[1] This strategy is updated regularly based on knowledge advancements in science, socio-economics and policy. Many technical guidelines, best practices and recommendations for the control of HPAI have been produced jointly, notably on the good governance of veterinary services, compensation policies, vaccination issues, the migratory behavior and field investigations of wild birds, and on biosecurity measures in the diverse poultry sector. To implement the strategy, FAO subsequently developed a Global Programme for the Prevention and Control of H5N1 Highly Pathogenic Avian Influenza[2] in 2006–2008. The programme aimed to address the required immediate and short-term interventions, while improving capacities for longer-term sustainable approaches to eliminate H5N1 HPAI from poultry. Since 2009, there have been increased efforts to understand and incorporate other important dimensions beyond traditional disease responses so that currently FAO's HPAI programme is an integrated, multidisciplinary approach which more fully includes vital aspects of disease control, such as biosecurity, socio-economics, public-private partnerships, wildlife aspects, understanding drivers of disease, and advocacy and communication.[3]

FAO's global programme implementation in countries directly affected by the disease outbreaks has been crucial to the success of the HPAI response, as well as to capacity-building for prevention, detection and response in over 130 countries. In 2004, the HPAI response required immediate and short-term interventions, while improving capacities for longer-term sustainable approaches which address the risk of recursion, endemic areas'/countries' needs, risk of additional emerging infectious diseases (EIDs) or incursions of transboundary animal diseases (TADs). To ensure countries' long-term success for HPAI and other diseases, FAO's work currently focuses on strengthening the animal health infrastructure, and developing capacity for surveillance, early warning, detection and timely response – a hallmark of the efforts expressed under the FAO Emergency Prevention System (EMPRES, 1994) for Transboundary Animal and Plant Pests and Diseases principles. Prevention and control has been achieved by also focusing efforts at the community level, taking into account local circumstances, livestock production and marketing practices, census and demographics, customs and traditions, economies and governing structures. Despite these advances, endemic foci continue to pose a threat to the global community. Building upon successes and lessons

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1 Available at http://www.fao.org/avianflu/documents/UNresponse.pdf

2 Available at http://www.fao.org/docs/eims/upload//234952/GlobProg2006.pdf

3 Available at http://www.fao.org/docrep/010/ai380e/ai380e00.htm

learned, FAO is working towards implementation of a pathway for progressive control of the disease in endemic countries tailored to the specific country and regional needs. Each pathway works toward consolidation of the disease situation and the progressive shift to containment and reduction of threats in the production environments.

Since early 2011, FAO has taken a broad, multisectoral, collaborative One Health approach and is currently implementing the strategic Action Plan (AP) 2011–2015 entitled: Sustainable animal health and contained animal-related human health risks – in support of the emerging One-Health agenda.[4] The AP extends the successful efforts and lessons learned from FAO's eight-year response to HPAI to other animal diseases that threaten animal and human health, rural populations and livelihoods. The goal of this plan is to establish a robust global animal health system that effectively manages major animal health risks, paying particular attention to the animal-human-ecosystem interface, and placing disease dynamics into the broader context of agriculture and socio-economic development and environmental sustainability.

FAO could not have accomplished these advances alone. The collaboration with WHO and the OIE has been crucial along with the technical and financial support received from many partners. Technical partners are too numerous to list here, but their invaluable contribution is gratefully acknowledged. Special gratitude is extended to the FAO Reference Centres for the provision of technical and advisory services to FAO member countries, to FAO and partners, and to the global understanding of dynamic disease for influenza viruses and other threats to food security and health. Financial support is provided by: Asian Development Bank (ADB), African Union Interafrican Bureau for Animal Resources (AU-IBAR), Australia, Bangladesh, Belgium, Canada, the Civilian Research and Development Foundation (CRDF), the Common Fund for Humanitarian Action in Sudan, China, the European Union, France, Germany, Greece, International Livestock Research Institute (ILRI), Ireland, Italy, Japan, Jordan, the Republic of Korea, Nepal, the Netherlands, New Zealand, Norway, the Organization of the Petroleum Exporting Countries (OPEC) Fund for International Development, Saudi Arabia, Spain, Sweden, Switzerland, the United Kingdom of Great Britain and Northern Ireland, United Nations Assistance Mission in Afghanistan (UNAMA), the United Nations Development Group Office (UNDGO), the United Nations Development Programme (UNDP), United Nations Development Programme Administered Donor Joint Trust Fund (UNJ), United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA), the United States of America, Viet Nam and the World Bank (WB).

Gratitude is extended to these countries, institutions and funding partners which further FAO's mission for a healthier world through sustained agricultural development, better nutrition and natural resource management.

Modibo Traoré
Assistant Director-General
Agriculture and Consumer Protection Department

4 This AP was endorsed by the programme committee in March 2011 (available at http://www.fao.org/docrep/meeting/021/ma145e.pdf).

Acronyms and abbreviations

ADB	Asian Development Bank
AECID	Spanish Agency for International Cooperation for Development
AED	Academy for Educational Development
AGA	Animal Production and Health Division (FAO)
AHC	Animal Health Clubs
AHI	avian and human influenza
AIWs	avian influenza workers
AP	Action Plan
ASEAN	Association of Southeast Asian Nations
ASF	African swine fever
AU-IBAR	African Union Interafrican Bureau for Animal Resources
BCC	behavioral change communication (Egypt)
CAHO	community animal health outreach
CAHW	community animal health worker
CBPP	contagious bovine pleuropneumonia
CCHF	Congo-Crimea haemorrhagic fever
CDC	Centers for Disease Control and Prevention
CERF	Central Emergency Response Fund
C-FETP	China Field Epidemiology Training Program (Public health)
CHF	Common Humanitarian Fund (Sudan)
CIS	Commonwealth of Independent States
CMC-AH	FAO/OIE Crisis Management Centre for Animal Health
CRDF	Civilian Research and Development Foundation
CVO	chief veterinary officer
DAFF	Department of Agriculture, Fisheries and Forestry (Australia)
DAH	Department of Animal Health (Viet Nam)
DLS	Department of Livestock Services (Bangladesh)
DVE	duck virus enteritis
EAC	East African Community
ECOWAS	Economic Community of West African States
ECTAD	Emergency Centre for Transboundary Animal Diseases
EDPLN	Emerging and Dangerous Pathogens Laboratory Network (WHO)
EIDs	emerging infectious diseases
EMPRES	Emergency Prevention System for Transboundary Animal and Plant Pests and Diseases
EMPRES-i	Global Animal Disease Information System
EPT	Emerging Pandemic Threats Program

ERV	Ebola-Reston virus
EU	European Union
EUFMD	European Commission for the Control of Foot-and-Mouth Disease
FAO	Food and Agriculture Organization of the United Nations
FETPV	Field Epidemiology Training Programme for Veterinarians (China)
FLI	Friedrich-Loeffler-Institut, Germany
FMD	foot-and-mouth disease
GARC	Global Alliance for Rabies Control
GEF	Global Environment Facility (FAO)
GEMP	Good Emergency Management Practices
GETS	Gathering Evidence for a Transitional Strategy (FAO/USAID funded project)
GFN	Global Foodborne Infections Network (WHO)
GF-TADs	Global Framework for the Progressive Control of Transboundary Animal Diseases
GIS	geographic information system
GISAID	Global Initiative on Sharing Avian Influenza Data
GliPHA	Global Livestock Production and Health Atlas
GLEWS	Global Early Warning and Response System (FAO/OIE/WHO)
GLW	Gridded Livestock of the World
GOVS	General Office of Veterinary Services
HAI	human-animal interface
H1N1	Pandemic (H1N1) 2009 (subtype of Influenza virus A)
H5N1	Subtype of the Influenza A virus
H9N2	Subtype of the Influenza A virus
HPAI	highly pathogenic avian influenza
HPED	highly pathogenic and emerging diseases
hvPRRS	highly virulent porcine respiratory reproductive syndrome
HVT	herpes virus of turkeys
IAEA	International Atomic Energy Agency
IDENTIFY	USAID FAO/OIE joint laboratory and surveillance programme
IEC	Information Education and Communication
IGAD	Intergovernmental Authority for Development
ILRI	International Livestock Research Institute
iNGOs	international non-governmental organizations
IRD	Influenza Research Database
IVM-AH	Influenza Virus Monitoring Laboratory Network for Animal Health (Indonesia)
IZSVe	Istituto Zooprofilattico Sperimentale delle Venezie
LAC	Latin America and the Caribbean
LBM	live bird markets
LIMS	laboratory information management system
LPAI	low pathogenic avian influenza
M&E	monitoring and evaluation
MDGs	Millennium Development Goals

MENA Middle East and North Africa
MoALR Ministry of Agriculture and Land Reclamation (Egypt)
MTA material transfer agreement
NDV Newcastle disease virus
NGOs non-governmental organizations
NLQP National Laboratory for quality control on poultry production (Egypt)
NVS National Veterinary Service (Indonesia)
OFFLU OIE/FAO joint network of expertise on avian influenza
OIE World Organisation for Animal Health
OPEC Organization of the Petroleum Exporting Countries
OpenFluDB Openflu database for human and animal influenza virus
PCP progressive control pathway
PDSR Participatory Disease Surveillance and Response
PPP public-private partnership
PPR peste des petits ruminants
PRP Partners for Rabies Prevention
PWB Programme of Work and Budget
REMESA Reseau Meditteranéen de Santé Animale (Mediterranean Animal Health Network)
RTE real-time evaluation
RT–PCR real-time polymerase chain reaction (lab test)
RVF Rift Valley fever
SAARC South Asian Association for Regional Cooperation
SADC Southern Africa Development Community
SARS severe acute respiratory syndrome
SIB Swiss Institute of Bioinformatics
SMS short message service
SO-B strategic objective B
SO-I strategic objective I
SOP standard operating procedure
SSM sequence similarities map
SVD Schmallenberg virus disease
TAD transboundary animal disease
TFCA Transfrontier Conservation Areas
TOT training of trainers
UMA Union du Maghreb Arabe
UN United Nations
UNAMA United Nations Assistance Mission in Afghanistan
UNDGO United Nations Development Group Office
UNDP United Nations Development Programme
UNICEF United Nations Children’s Fund
UNJ United Nations Development Programme Administered Donor Joint Trust Fund
UNOCHA United Nations Office for the Coordination of Humanitarian Affairs

UNSIC	Senior United Nations System Coordinator for Avian and Human Influenza
VAHW	village animal health worker
VBD	vector-borne diseases
VVW	village veterinary workers
WAHID	World Animal Health Information Database (OIE)
WB	World Bank
WHO	World Health Organization
WHO GAR	World Health Organization Global Alert and Response
WHO–SEARO	World Health Organization–South-East Asia Regional Office
WILD	Wildlife Investigation in Livestock Disease and Public Health
WNV	West Nile virus

Executive summary

The Food and Agriculture Organization of the United Nations (FAO) has been in the forefront of the global effort to fight highly pathogenic avian influenza (HPAI) over the last eight years since its emergence in Southeast Asia. FAO's collaborative HPAI global programme has significantly contributed to limiting the impact of the disease, establishing stronger national systems and strengthening regional coordination for disease preparedness, prevention and control. With the continuous support of the international donor community, national governments, regional and international organizations, development agencies and international development banks, sustained coordinated action has progressively reduced the number of countries affected by H5N1 HPAI and the disease has now been eliminated from most of the countries in the world. This result was achieved by assisting national veterinary services to develop preparedness and contingency plans, by improving surveillance systems that interface between animal and public health authorities, by acquiring laboratory resources and disease diagnostic capacity, by developing response capabilities, communication and awareness and by promoting biosecurity along the value chain.

Since the emergence of zoonotic H5N1 HPAI, the disease situation has evolved considerably. Currently, H5N1 HPAI is endemic in Bangladesh, China, Egypt, Indonesia, Viet Nam and large parts of eastern India. A number of countries in Asia, including the Lao People's Democratic Republic, Cambodia, Myanmar and Nepal, also experience regular, but sporadic, outbreaks. A number of elements that inhibit progress towards disease control, prevention and elimination from the poultry sector are common to endemically infected countries/regions. The major identified challenges in endemic countries fall into three groups: (1) the structure of the poultry sector (i.e. production and marketing or trading methods); (2) weaknesses in veterinary services and animal production services; and (3) insufficient commitment from the public and private sectors to elimination of the virus. Measures have been introduced in these countries to address the major identified challenges, but all require further long-term commitments and investment if the virus is to cease being a threat to human health and safe and efficient poultry production. To move forward, each of the endemically infected countries should implement activities that take them closer to virus elimination and reduce the prevalence of disease in poultry and humans, progressively building upon the gains made since they first reported cases of the disease.

In the past few years, a newer variant of the H5N1 virus, referred to as clade 2.3.2.1, has emerged and expanded its geographic range from Southeast Asia to East Asia, South Asia and Eastern Europe. Some variants of clade 2.3.2.1 are different enough from other H5N1 avian influenza clades so that poultry vaccinations are becoming ineffective in some countries. This clade appears to have evolved in domestic poultry in China with altered characteristics and a higher virulence in wild birds. The virus clade 2.3.2, in its various forms, exists in China and may continue to expand its geographic range from Southeast Asia to other regions.


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The information generated from isolation, and genetic and antigenic characterization of a large number of viruses in Asia and other parts of the world, coupled with the information on disease outbreaks, has improved our understanding of the virus's evolution and its implications with regard to its spread, infectivity and suitability for use in development of vaccines. The current trends in evolution present a number of concerns and work will need to continue on surveillance and virus isolation and characterization.

Changes in the virus and technical challenges with current vaccines, especially to prohibit or protect infection ducks, as well as the need for vaccine options and flexibility per production settings, necessitate improved vaccine tools. Vaccination discussions and guidance at the global level would benefit endemic countries' further development of comprehensive, sound vaccination policies with clearly defined exit strategies.

Successful animal health programmes involve engagement and partnership from all levels. Also, countries require sufficient and sustained investment in animal health services. Essential aspects include capacity to prevent, prepare, detect and respond (e.g. adequate numbers of trained personnel, surveillance and laboratory capacity, appropriate biosecurity, and vaccination tools), coordination, communication and socio-economic analysis to understand the causes or drivers of disease.

Coordination must be at all levels – local, national, regional and global. Global efforts provide frameworks in a systems approach upon which more targeted regional, national and local disease prevention, detection, control, response or eradication plans are efficiently designed, implemented and monitored, including required adjustments made with inputs from the private sector. Regional HPAI and other disease plans have centred on communication, coordination, surveillance, and data gathering and analysis. In 2011, FAO conducted or supported annual regional coordination meetings in all regions where FAO projects exist (North Africa, West/Central Africa, Eastern Africa, Southeast Asia, and South Asia). Pathogens and vectors do not recognize political or geographical boundaries and today's globalized world increases that reality. Animal movement, trade and human movement as well as endemic, emerging and re-emerging pests and diseases around the world will demand a continuing and improved level of global and regionally coordinated infrastructure and discussion.

Additionally, FAO's activities have fostered collaborations at the local and national level. For example, before the pandemic threat, in many countries, the ministries of agriculture, human health, wildlife, environment or food safety did not work together. To deal effectively with HPAI at the national level, many countries put interministerial structures of coordination into place to enable a national systems approach to respond better to the threat. While HPAI and the potential of a pandemic served as the impetus for initial or improved intergovernmental coordination, the experiences of coordination between animal health and human health authorities in dealing with HPAI also bode well for future collaboration. Foundations have been laid for these authorities to better address other animal diseases, zoonotic diseases and for collaboration on possible emerging infectious diseases. Additionally, interministerial and cross-sectoral collaborations develop trust among partners and cross-pollinate areas of expertise.

The HPAI systems approach has matured to apply a methodical systems framework approach to foot-and-mouth disease (FMD) which culminated in the development of the FAO/OIE progressive control pathway for FMD (PCP-FMD) in 2011.[5] The approach is currently in process for other high impact diseases such as brucellosis, contagious bovine pleuropneumonia (CBBP), peste des petits ruminants (PPR) and rabies. PCPs help countries ascertain where they are in regards to the particular disease, so that they can then progressively reduce the impact and load of the disease agent through improved risk management based on surveillance studies and targeted interventions. PCPs are a working tool in the design of country, and some regional, control programmes.

Activities in 2011 also included extensive efforts for integrated training of field and laboratory personnel in design and analysis of surveillance data to improve coordination at country and regional levels, including the Field Epidemiology Training Programme for Veterinarians (FETPV) and the laboratory and epidemiology networks. FAO expanded FETPV to develop a human-wildlife-environment interface module, which will be delivered to more than 45 countries by mid-2012.

Surveillance is now a risk-based, targeted and more comprehensive approach that recognizes the dynamic and complex nature of today's world. Current activities are to integrate environmental and food safety data into the wildlife, livestock, poultry and duck data so that a more integrated comprehensive picture of a particular disease or pathogen can be used to better inform decisions, which, in turn, leads to improved results. Included in this activity are innovative means of data collection (e.g. mobile devices, participatory approaches) that reflect today's global world and provide flexibility for the structures of each country and local community.

FAO has been emphasizing the need to shift away from didactic, top-down communication towards processes and tools that are driven by deeper community participation and voluntarism. The communication strategies developed are also tailored for the multiple stakeholder levels, outlets and consumers.

HPAI highlighted the importance of understanding stakeholder behaviour and how it can affect disease spread as well as its management and control. Incentives for stakeholders

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5 In 2011, the FAO FMD PCP became a joint FAO/OIE tool and forms the backbone of *The global foot and mouth disease control strategy: strengthening animal health systems through improved control of major diseases* published in July 2012 (available at http://www.fao.org/docrep/015/an390e/an390e.pdf). For more information on PCP-FMD see http://www.fao.org/ag/againfo/commissions/en/eufmd/pcp.html

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and the context within which they operate must be understood and taken into account. Successful disease control interventions or programmes, require stakeholder engagement up front, a detailed value chain assessment, control impact assessments and economic cost/benefit analysis, including assessment for other livestock subsectors. Engaging and including stakeholders from the beginning will enable practical sustainable solutions, balancing disease control needs with human livelihood needs. Socio-economic work is now concentrating on improving the understanding of the livelihoods, demands and decisions made by livestock producers, on the economics and relationships they have across the value chains, and on identifying gaps in technologies within this context. Additionally, these efforts will provide useful information to improve many of the outstanding biosecurity issues in endemic countries.

While much progress has been made, HPAI remains a significant threat to the poultry industry, destabilizing agriculture in countries where backyard farming of domestic ducks is common, impacting the food security and livelihood of millions of people and maintaining a very real potential for emergence of a pandemic human influenza. Despite the fact that nearly all H5N1 human infections to date appear to have been the result of transmission of the virus from poultry to people, the continued presence in poultry in numerous countries, its tendency to quickly mutate and change, its ability to infect humans and its continuing high case fatality rate remain a concern. A continued pandemic potential is extra troubling given the mounting evidence of increasingly active bi-directional swine-human virus genetic exchange in the form of reassortments of H3 and H1 viruses. Also, it appears that 2011 marked an increase of avian origin H5N1 and H9N2 virus segments into the swine gene pool.

None of the successes against H5N1 HPAI and other transboundary animal diseases (TADs) could be possible without technical, policy and funding partnerships. At its peak, FAO's HPAI global programme comprised 168 donor-supported projects, of which 64 remain active, with more than half of them in Asia. Coordination and partnerships at the local, national, regional and global level have been essential in the eight-year HPAI effort in all countries. Coordination and a concerted, sustained effort are vital in endemic areas. FAO has played a central role in forging and coordinating partnerships among a number of players and stakeholders involved in the control of HPAI and other high impact emerging and re-emerging infectious diseases.

These have included partnerships with national governments, non-governmental organizations (NGOs), donors, national and international research institutes, regional organizations and other international developmental and technical agencies.

These collaborative efforts to address the problem of H5N1 HPAI have clearly yielded significant results. Yet much work remains to be done to further address ongoing influenza threats as well as other zoonotic and TADs.

Due to the H5N1 HPAI pandemic experience, the global conversation has begun to move away from emergency response against individual diseases towards including more measured and integrated action for the long-term prevention of endemic, emerging and re-emerging infectious diseases. FAO has taken the lessons learned from the HPAI global programme and is applying this knowledge in approaches to the control of other emerging infectious diseases (EIDs) and high impact TADs, in addition to HPAI. This work is being done in the context of a One Health strategic framework, the FAO Action Plan (AP) (2011–2015) entitled, Sustainable animal health and contained animal-related human health risks – in support of the emerging One-Health agenda.[6] The goal of this plan is to establish a robust global animal health system that effectively manages major animal health risks, paying particular attention to the animal-human-ecosystem interface, and placing disease dynamics into the broader context of agriculture and socio-economic development and environmental sustainability.

One Health addresses threats and reduces risks of emerging and re-emerging infectious disease through a collaborative, international, cross-sectoral, multidisciplinary approach. FAO has taken the lead in advocacy to develop regional and local mechanisms and platforms for intersectoral work and the AP, in part, is designed for local level implementation. A suite of tools, such as simulation exercises, risk assessment along value chains, and livestock field schools are available to bring together different relevant sectors to identify strengths and weaknesses of the coordination, cooperation and communication for emergency preparedness. The actions recommended are risk-based and tailored to the local context engaging the people involved through participatory processes. The AP promotes a proactive approach to disease risk management. All actions of the AP aim at sustainability and ownership by countries and regions and range from immediate to long-term actions with a developmental perspective.

Advocacy initiatives at the country and regional level provide a wider focus on infectious diseases of high impact and facilitate information sharing, improved evidence-based decision-making and a more strategic and effective long-term prevention and response capacity for animal, human and zoonotic pathogens.

To date, the One Health approach has been used to address infectious diseases, but it has been recognized that this framework can be used across disciplines to address a wider range of issues across the three health domains. While the etiology of One Health stems from infectious diseases, it is clear that the application of this approach can contribute to ensuring global food securit.

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6 Endorsed by the programme committee in its 106th session in March 2011, this AP proposes a programme in five technical areas of work supported by three functional areas of work with key actions to deliver the expected results (available at http://www.fao.org/docrep/meeting/021/ma145e.pdf).

Introduction

This fifth report on the FAO global programme on HPAI covers the period 2011–2012 and provides an overview of the disease situation, the activities conducted and the strategic approach with respect to the reduction of infection in endemically infected countries. This report will be the last that focuses primarily on the HPAI global programme. As introduced in the fourth HPAI global report, FAO has taken the lessons learned from the six-year HPAI response and has begun applying this knowledge in approaches to the control of other EIDs and high-impact TADs in addition to HPAI. Specific highlights will focus on current efforts that build upon successes, capacity and knowledge gained in the HPAI response as well as learning from continued challenges. This work is being done in the context of a One Health strategic framework.

One Health is a collaborative, cross-sectoral, multidisciplinary approach to addressing threats and reducing risks of endemic, emerging and re-emerging infectious diseases. More specifically, it acknowledges the animal-human-ecosystem interface, and places disease dynamics into the broader context of agriculture and socio-economic development and environmental sustainability. FAO developed a strategic AP (2011–2015) entitled, Sustainable animal health and contained animal-related human health risks – in support of the emerging One-Health agenda.[7] Progress was made in 2011 to put the plan into action at the local field level, with further development underway in 2012. This report will highlight a few areas of advancement. It is anticipated that future reports will focus on this holistic arena of FAO's activities which recognizes the animal-human-ecosystem interface and contributes to the prevention, detection and containment of major animal diseases and related human health risks globally. FAO is committed to animal health and natural resource management and to increasing sustainable livestock production.

This report does not reiterate the detailed matters covered in the previous reports, especially those in the comprehensive Fourth Report January to December 2010: Global Programme for the Prevention and Control of Highly Pathogenic Avian Influenza.[8] For further information, readers are advised to refer to these reports[9] and to the avian influenza section on the FAO website.[10]

The activities of the HPAI global programme and all other animal health activities in this report are carried out in conjunction with partner organizations and donors and are intimately linked to the FAO strategic framework[11] which is detailed in The Director-General's Medium Term Plan 2010-13 and its biennial Programme of Work and Budget 2010-11 (PWB).[12] The activities of the HPAI programme and One Health AP contribute to the medium

[7] Available at http://www.fao.org/docrep/meeting/021/ma145e.pdf
[8] Available at http://www.fao.org/docrep/014/i2252e/i2252e00.pdf
[9] Available at http://www.fao.org/avianflu/en/strategydocs.html
[10] Available at http://www.fao.org/avianflu/en/index.html
[11] Available at http://ftp.fao.org/docrep/fao/meeting/017/k5864e01.pdf
[12] Available at http://www.fao.org/docrep/meeting/017/K5831E.pdf

term plan's strategic objective B (SO-B): Increased sustainable livestock production and strategic objective I (SO-I): Improved preparedness for, and effective response to, food and agricultural threats and emergencies.

Global and local, multisectoral, multidisciplinary coordination and collaboration is crucial for achieving the goals outlined, and FAO has a variety of mechanisms for interaction with partner organizations which are utilized in the global programme and the AP (including the tripartite FAO/OIE/WHO agreement to advance the One Health agenda at the global level, the FAO/OIE Global Framework for the Progressive Control of Transboundary Animal Diseases (GF-TADs), the FAO/OIE/WHO Global Early Warning and Response System (GLEWS), the OIE/FAO joint network of expertise on avian influenza (OFFLU), the Crisis Management Centre-Animal Health (CMC-AH), FAO Reference Centres and the Joint FAO/International Atomic Energy Agency (IAEA) Programme on Nuclear Techniques in Food and Agriculture,[13] among others.

[13] Available at http://www-naweb.iaea.org/nafa/index.html

Chapter 1

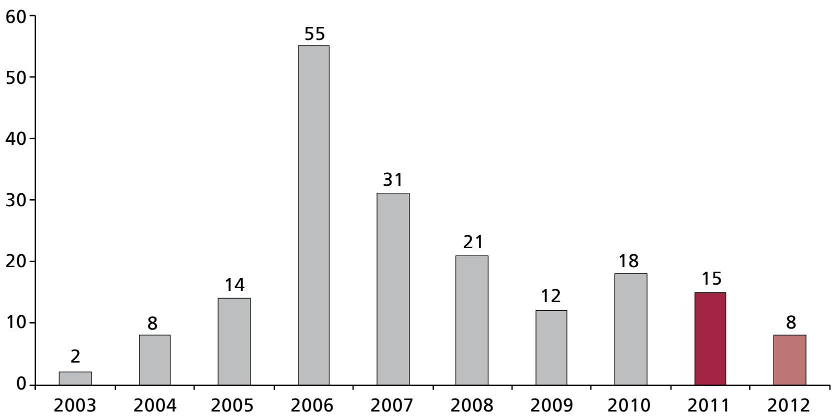
H5N1 highly pathogenic avian influenza and other diseases situation update (January 2011 to January 2012)

OVERALL H5N1 HIGHLY PATHOGENIC AVIAN INFLUENZA INCIDENCE INCREASED IN ANIMALS IN 2011

H5N1 HPAI has affected sixty-three countries/territories in Asia, Europe and Africa since the beginning of the epizootic in poultry, wild birds or captive wild birds in 2003. Of these, 15 countries (14 in Asia; and 1 in Africa) experienced outbreaks during 2011 and 2012 (see Figures 1.1 and 1.2; Table 1.1), against 18 in 2010 and 12 in 2009 (see Figure 1.1). H5N1 HPAI continues to be a major concern, with a slight decrease in the overall number of infected countries/territories in 2011 and 2012. However, the disease is entrenched in poultry populations only in Bangladesh, China, Egypt, Indonesia, Viet Nam and parts of India. In these settings, progressive control and elimination remains the long-term goal.

FIGURE 1.1

Number of H5N1 HPAI-infected countries from December 2003 to January 2012

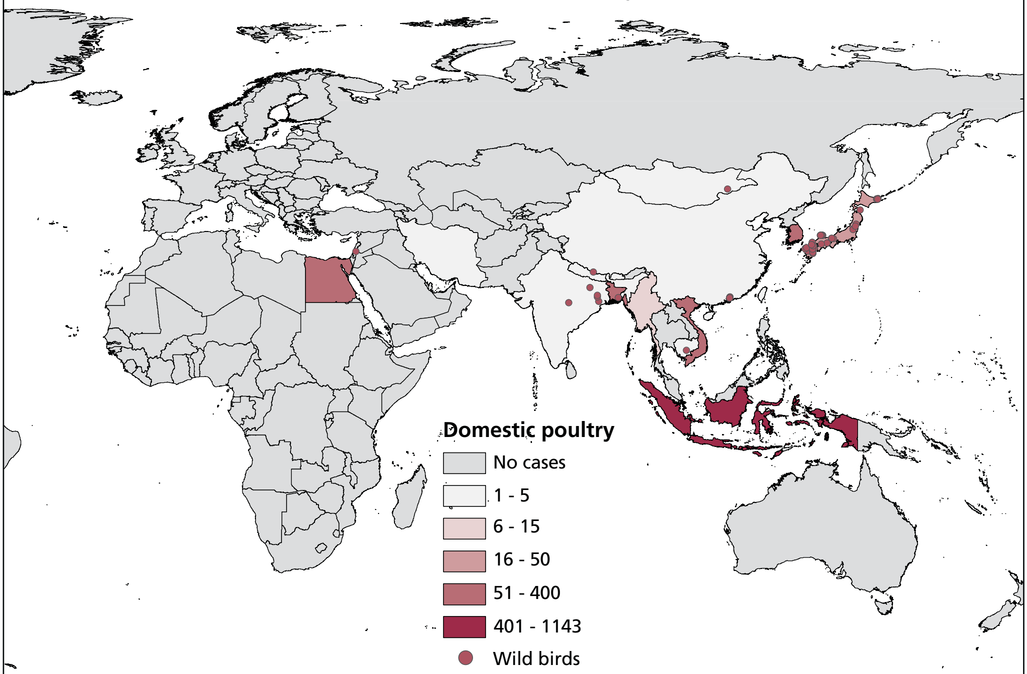


Countries reporting H5N1 HPAI in 2011: Bangladesh, Bhutan, Cambodia, China, Egypt, China, Hong Kong SAR, India, Indonesia, Islamic Republic of Iran, Japan, Mongolia, Myanmar, Nepal,the Democratic People's Republic of Korea, Viet Nam, the West Bank

Countries reporting H5N1 HPAI in 2012: Bangladesh, Bhutan, China, India, Indonesia, Nepal, Viet Nam

Source: FAO EMPRES-i, OIE WAHID.

FIGURE 1.2
H5N1 HPAI events in domestic poultry and wild birds in 2011



Source: FAO EMPRES-i, OIE WAHID.

The overall number of reported outbreaks/cases of H5N1 HPAI worldwide increased in 2011 compared to the same period in 2010, partly due to unusual reporting from previously infected countries particularly associated with wild bird events. There was a general decrease in outbreak numbers at the country level during 2011, with the exception of Japan, the Republic of Korea and Bangladesh where increases were observed (see Table 1.1). In Bangladesh, the situation appears to have worsened considerably during 2011, where a five-fold increase in outbreak numbers was observed. The peak of disease activity in 2011 was, once again, observed in the cooler months of January to March (see Figure 1.3).

Since 2004, an improvement in disease awareness worldwide can be noted, but as has been reported previously there are still some concerns about the efficiency of surveillance systems. Outbreaks/cases of H5N1 HPAI are still likely to be underestimated and under-reported in some countries owing to limitations in the capacity of veterinary services to implement sensitive and effective disease surveillance, or to perform epidemiological investigations. Most animal disease surveillance systems depend on livestock owners to report suspicious incidents, but the general weakness of compensation schemes means there are poor incentives for disease reporting by owners.

FOUR HIGH-BURDEN COUNTRIES REMAIN ENZOOTIC

The majority of outbreaks in 2011 and early 2012 occurred in four high burden countries (see Table 1.1): Indonesia (60 percent), Egypt (20 percent), Bangladesh (8 percent), and

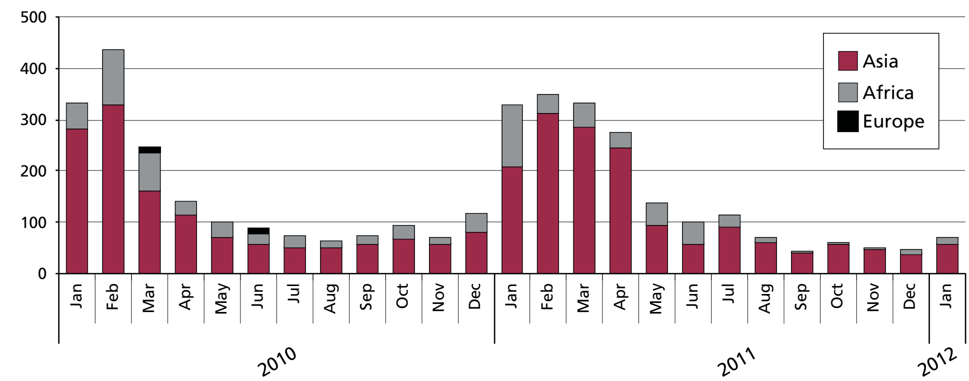
TABLE 1.1
Number of outbreaks during 2009-2010

	Bangladesh	Bhutan	Bulgaria	Cambodia	China	Egypt	Germany	India	Indonesia	Israel	Iran	Japan	Lao People's Democratic Republic	Mongolia	Myanmar	Nepal	Republic of Korea (the)	Romania	Russian Federation (the)	Viet Nam	west Bank
2009	32	0	0	1	19	176	1	10	1502	0	0	0	5	2	0	2	0	0	2	56	0
2010	31	5	1	2	3	443	0	15	1204	2	0	5	1	1	3	8	8	2	1	51	0
2011	145	2	0	5	9	378	0	6	1155	0	3	74	0	1	9	1	53	0	0	47	3
2012	4	3	0	0	6	15	0	7	22	0	0	0	0	0	0	4	0	0	0	8	0

Viet Nam (3 percent) as well as countries like Japan (4 percent) and the Republic of Korea (3 percent) where the disease is considered sporadic. This result is slightly different from the situation in 2010 and may be attributed to expansion of clade 2.3.2.1 in Asia.

During 2011, **Bangladesh** (see Figure1.4) experienced an increase in outbreak numbers in poultry (from 31 in 2010 to 145 in 2011), mostly in commercial poultry from five areas, three of which were infected during 2010. Areas affected in Bangladesh were Barisal, Chittagong, Dhaka, Khulna, Rajshahi and Sylhet. Although, like previous years, most outbreaks occurred between January and April, outbreaks were observed during 10 out of 12 months. A new incursion of clade 2.3.2.1 was observed for the first time in Bangladesh (in crows and chickens) in January and February, and this is now the dominant strain with some evidence of spillover into India. Virus clades from outbreaks between April and June 2011 belonged to clade 2.3.2.1 and 2.2.2. Clade 2.3.4.2 was identified in poultry in February 2011 in the Chittagong District. The virus isolates from the 2010 outbreaks belonged to clade 2.2, sublineage III and clustered with sequences of viruses from Bangladesh isolated from 2007 to 2009.

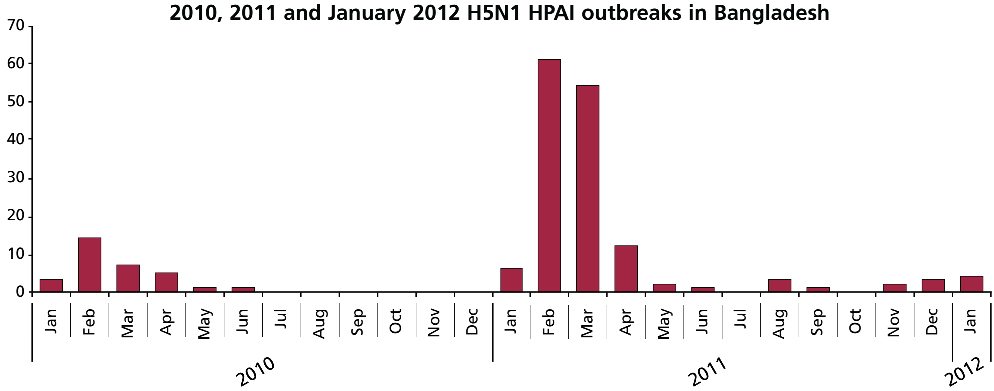
FIGURE 1.3
Number of reported H5N1 HPAI outbreaks/cases by continent, by month from January 2010 to January 2012



Source: FAO EMPRES-i, OIE WAHID.

FIGURE 1.4

2010, 2011 and January 2012 H5N1 HPAI outbreaks in Bangladesh

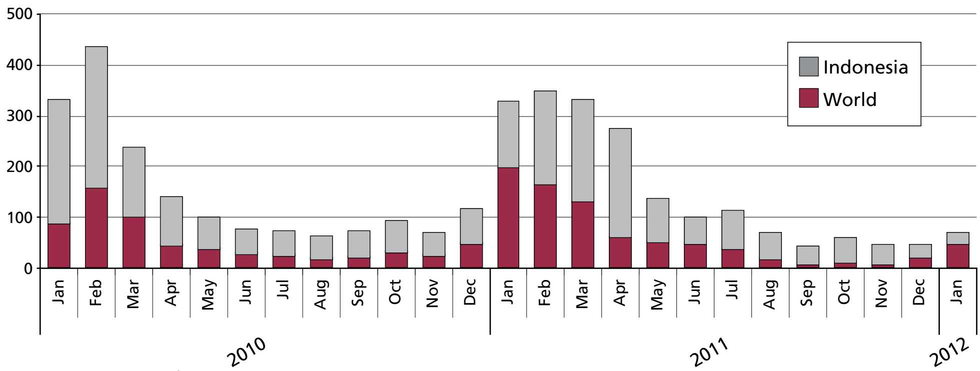


Source: FAO EMPRES-i.

Indonesia continued to report a high number of H5N1 HPAI outbreaks in poultry during 2011. Pursuant to past years, there appears to be a non-significant reduction from the previous year (1204 in 2010 versus 1155 in 2011). More outbreaks were reported in the country itself than the rest of the world combined (see Figure 1.5). H5N1 HPAI is considered endemic on the islands of Java, Sulawesi and Sumatra, with sporadic outbreaks reported elsewhere. High incidence areas are recognized at both provincial and district levels on Java (especially Yogyakarta) and in the south of Sumatra (Lampung). Only one of Indonesia's 33 provinces (Maluku) has never reported the occurrence of H5N1 HPAI. The high number of reports each month is partially explained by the implementation of FAO's Participatory Disease Surveillance and Response (PDSR) programme which targets village poultry production systems (mainly backyard) and reports outbreaks at the village level. Clade 2.1 was isolated in 2009, but no sequence data is available for isolates from 2010 or 2011 outbreaks. Indonesian virus sequences from 2009 to 2010 show that these isolates remain in clade 2.1.3. Presently, no 2011 sequence data from animal viruses are available. The data shows that within Indonesia clade 2.1.3 continues to diversify with the largest variations observed in viruses from Sumatra.

FIGURE 1.5

Outbreaks in Indonesia in 2010 to 2012 compared with the rest of the world



Source: FAO EMPRES-i.

In **Viet Nam**, between January 2011 and January 2012, the Department of Animal Health (DAH) officially reported 55 H5N1 HPAI outbreaks in 22 of 64 provinces (34 province-level prevalence) involving ducks and chickens in northern, central and southern parts of the country. This result is comparable to that observed in 2010 with 21 out of 64 provinces affected. Surveillance and molecular genetics have indicated the presence of four circulating virus clades in Viet Nam since 2003. These are: (1) clade 1.1 (predominant in southern Viet Nam from 2004 until now; (2) clade 2.3.4 (predominant in northern Viet Nam from 2007 to the first half of 2010); (3) clade 7 (detected in poultry seized at the Chinese border and at markets near Hanoi in 2008); and (4) clade 2.3.2 (detected in 2005 for the first time and reappearing in late 2009). Virus clade 2.3.2.1 has become predominant in northern Viet Nam since late 2010 until now. It was also detected in the south-central area of Viet Nam. In a vaccine efficacy trial, it was observed that the current vaccines in use in Viet Nam provided poor protection against one particular virus strain within virus clade 2.3.2.1. This virus strain forms a distinct cluster from most of the other virus strains of clade 2.3.2.1 in the HA gene phylogeny. This strain was detected in seven northern provinces of Viet Nam during the period 2011 to 2012. In 2011, Viet Nam temporarily halted government-sponsored vaccination in the northern and central areas of the country in response to the emergence of this new clade of H5N1 virus, when the vaccine in use was found to be ineffective against it. However, vaccination continues in the south and an emergency stock of vaccine for ring vaccination is maintained for use in the country.

Egypt continued to report large numbers of outbreaks predominantly in backyard systems during 2011 to January 2012 in most of its 29 governorates. Compared to 2010, there has been a slight reduction in outbreaks from 443 in 2010 to 378 in 2011, possibly due to reduction in surveillance activities as the result of civil unrest. In Egypt, detection of HPAI is the result of surveillance conducted in high-risk governorates by community animal health outreach (CAHO); (similar to PDSR in Indonesia), as well as active surveillance conducted in the commercial and village poultry sectors. Egyptian viruses isolated in 2011 belonged to the 2.2.1 group (the so-called classical or A group). Viruses belonging to the variant or B group, now the fourth order clade 2.2.1.1, were not isolated in 2011.

SPORADIC H5N1 HPAI EVENTS STILL PREDOMINANTLY IN ASIA

Southeast Asia

Cambodia experienced four H5N1 HPAI poultry outbreaks and one wild bird event during 2011 in five areas representing an increase from 2010 (two poultry outbreaks). Affected areas in 2011 were Banteay Meanchey, Takeo, Battambang and Kandal. Of these, only Takeo was infected in 2010. Like previous outbreaks in Cambodia, poultry outbreaks in 2011 were identified after reports of human cases, particularly in Banteay Meanchey. All available human and animal isolates since 2004, including all those from 2011, are clade 1.1 (genotype Z) and most closely related to clade 1.1 viruses previously circulating in Cambodia. This clade is also the same that circulates predominantly in southern Viet Nam.

The Lao People's Democratic Republic did not report H5N1 HPAI outbreaks during 2011, but results from active surveillance in high-risk areas have positive swab samples for HPAI H5N1, clade 2.3.2.1 in the Vientiane Capital. These results imply that the virus is still circulating in the country despite the lack of outbreak reports. The 2011 active surveillance was carried out in the nine highest-risk provinces based on the location of historical HPAI outbreaks. The surveillance focused on ducks in live bird markets (LBMs), and villages with high duck populations and farms. A total of 33 markets, 40 villages and 19 farms were visited during two rounds.

Myanmar experienced an increase in H5N1 HPAI outbreaks in poultry during the first four months of 2011 (11 outbreaks reported compared to 3 in the same period in 2010). Outbreaks were concentrated in Rakhine and Saigang, in the south and northwest of the country, respectively. Similar to 2010, viruses circulating in 2011 belonged to separate clades: clade 2.3.4.2 and clade 2.3.2.1.

East Asia

China reported one outbreak of HPAI H5N1 in poultry in Tibet in December 2011 and a number of H5N1 HPAI related events in poultry and wild birds in **China, Hong Kong SAR** during the first and last quarter of 2011 and January 2012. Specifically**,** in China, Hong Kong SAR**,** there were four wild bird events and four outbreaks in reported poultry during 2011. In addition to the wild bird events in December, one positive chicken carcass was identified in a LBM as part of ongoing active surveillance. This latter finding led to the immediate culling of 19 451 poultry, including 15 569 chickens, 810 pigeons, 1 950 pheasants and 1 122 silky fowls in China, Hong Kong SAR. In January 2012, there were one poultry outbreak and six wild bird events.

Though no outbreaks were reported during the first three-quarters of 2011 on mainland China, ongoing active surveillance in LBMs at national and provincial levels during March, June and July resulted in virus-positive samples, implying that H5N1 viruses are still circulating in many provinces in domestic poultry and that disease outbreaks go unnoticed by the authorities. Virus-positive provinces identified during 2011 include Anhui, Chongqing, Guangdong, Guangxi, Hubei, Hunan, Fujian, Zhejiang, Guizhou, Henan, Sichuan, Yunnan, Zhejiang, Jiangxi and Jiangsu. All the clades of Asian-lineage H5N1 HPAI virus found globally have been detected in China. Of particular interest is the recent expansion of clade 2.3.2.1 which was originally isolated in 2004 from a dead Chinese pond heron in China, Hong Kong SAR and has now expanded its geographic range to include Mongolia, the Russian Federation, Nepal, Romania and Bulgaria. In China, Hong Kong SAR, viruses from clade 2.3.4 were also detected in wild birds and poultry in 2009. The recent positive events in wild birds and poultry carcass are associated with clade 2.3.2.1.

Japan experienced a new incursion of H5N1 HPAI outbreaks in poultry (n = 26) and wild birds (n = 48) during the first two months of 2011 throughout the country. These events followed on H5N1 HPAI events in wild birds identified during late 2010 in a number of Prefectures (Kagosima, Tottori and Toyama). In 2011, as in 2010, virus isolates belonged to clade 2.3.2.1.

The **Republic of Korea** reported 53 H5N1 HPAI outbreaks in poultry (ducks and chickens) during the first five months of 2011, unlike 2010 during which only wild bird event was identified during November and December. Outbreaks in poultry during 2011 were distributed across six provinces (Chollabuk-do, Chollanam-do, Chungchongnam-do, Kyonggi-do, Kyongsangbuk-do and Pusan). Most outbreaks were in Chollanam-do (23 out of 53) and Kyonggi-do (19 out of 53). Viruses circulating in 2011 were clade 2.3.2.1.

In 2011, similar to 2010, one H5N1 event was confirmed in **Mongolia** in wild birds in April (whooper swans at Zegst Lake, Suhbaatar Province). Phylogenetic analyses confirmed the virus responsible was clade 2.3.2.1.

South Asia

Bhutan reported five H5N1 HPAI outbreaks in poultry during December 2011 and January 2012 in backyard birds. Though the clade responsible for these outbreaks is not yet known, outbreaks during 2010 were associated with clade 2.2 viruses detected in India and Bangladesh.

India experienced an unusual number of wild bird events in crows (n = 5) as well as outbreaks in poultry (n = 4) during 2011 and January 2012. Wild bird events were observed in crows during October, November and January in Orissa, Bihar and Maharashtra, with high levels of mortality. The clade involved is 2.3.2.1.

Nepal reported one clade 2.3.2.1 H5N1 HPAI outbreak in poultry in the central area during November 2011. In January 2012, one crow and three poultry outbreaks related to 2.3.2.1 viruses were reported.

Middle East

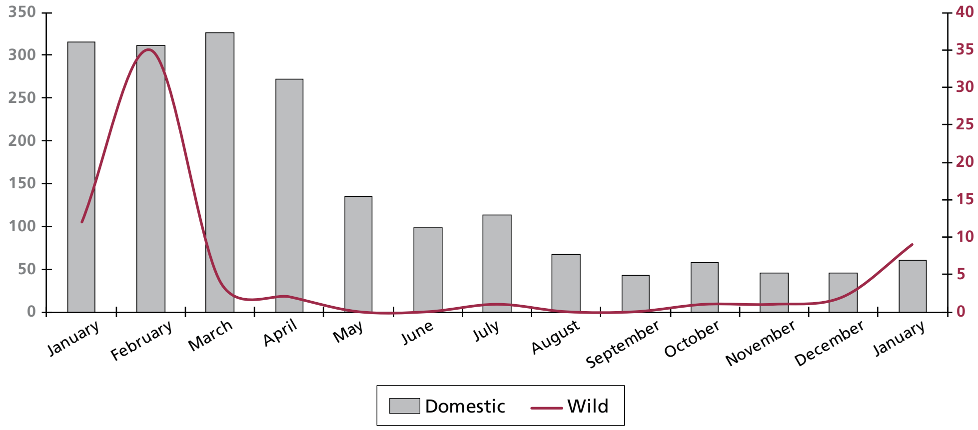
In the **West Bank** three H5N1 HPAI events were observed in 2011; one in wild birds and two in domestic turkeys. This report was the first record of H5N1 HPAI in wild birds in this country and the first report in poultry since 2006. The source of the outbreaks is unknown. The outbreaks in poultry were associated with virus clade 2.2.1; isolates that were previously found in poultry outbreaks in Israel and Egypt in 2010.

KNOWLEDGE GAPS REMAIN ON THE ROLE OF WILD BIRDS

During January 2011 to January 2012, there were reports of wild bird events/mortalities due to H5N1 HPAI in seven countries in Asia involving over 27 species. Affected countries/territories were Bangladesh (2011), Cambodia (2011), China, Hong Kong SAR (2011 and January 2012), India (2011 and January 2012), Japan (2011), Mongolia (2011), the West Bank (2011) and Nepal (January 2012). What is most relevant during this period is the large crow die-offs (greater than 1 143) observed from October 2011 in India associated with virus clade 2.3.2.1 with no apparent link to poultry outbreaks. Additionally, there were simultaneous reports of wild bird mortalities in Nepal in crows also associated with virus clade 2.3.2.1. The number of outbreaks in the January 2011 to January 2012 period represents an increase from 2010 (14 to 58), due primarily to increased reports from Japan (n = 48) and India (n = 7). (See Figure 1.6).

Compared to the number of outbreaks reported globally in domestic poultry in 2011 (see Figure 1.6), wild bird event reporting continues to be considered as rare. The wild bird species infected in January 2011 to January 2012 included several species of waterfowl, typically implicated in sustaining avian influenza virus transmission. These included dabbling and diving ducks (Northern Pintail, *Anas acuta*; Mandarin Duck, *Aix galericulata*; Common Pochard, *Aythya farina*; Greater Scaup, *Aythya marila*; Tufted Duck, *Aythya fuligula*; and unidentified species of ducks), swans (Black Swan, *Cygnus atratus*; Tundra Swan, *Cygnus columbianus*; Whooper Swan, *Cygnus Cygnus*; and an unidentified species of swans) along

FIGURE 1.6
Number of outbreaks in domestic poultry and wild birds from January 2011 to January 2012



Source: FAO EMPRES-i.

with an unidentified species of geese. Other water birds, normally closely associated with congregations of waterfowl, were infected with H5N1 HPAI. These were grebes (Little Grebe, *Tachybaptus ruficollis*; Great Crested Grebe, *Podiceps cristatus*; and an unidentified species of grebe), cranes and herons (Hooded Crane, *Grus monacha*; Little Egret, *Egretta garzetta*; Grey Heron, *Ardea cinerea*), gulls (Black-headed Gull, *Chroicocephalus ridibundus*; and an unidentified species of gull). In the past, a number of predatory species of birds, including one owl, were found to be positive (Marsh Harrier, *Circus aeruginosus*; Peregrine Falcon, *Falco peregrinus*; Crested Goshawk, *Accipiter trivirgatus*; Goshawk, *Accipiter* sp.; Ural Owl, *Strix uralensis*) most likely as a result of feeding on infected prey. Typical scavengers, such as crows (House Crow, *Corvus splendens Corvus* sp.) were also reported as well as one species of small passerines (Oriental Magpie Robin, *Copsychus saularis*). Since the beginning of the H5N1 epizootic, over 100 species from 13 orders of bird have been infected with H5N1 AI virus.

The epidemiological role of water birds, particularly waterfowl, in the introduction and spread of H5N1 HPAI, has been significantly clarified but remains controversial because the presence of wild birds at a location when a new HPAI outbreak occurs only increases suspicion about their role. The actual transmission mechanism among wild birds and poultry remains unconfirmed. However, the H5N1 HPAI virus incursion into Japan and the Republic of Korea during 2011 occurred during a period of significant negative surface air temperature anomalies; conditions that were similar to those observed during the clade 2.2 invasion into Europe and other regions in 2006.[14, 15, 16] While it is clear that virus transmission takes place among wild bird populations for low pathogenic avian influenza (LPAI) viruses, and that there is likely some leap-frog transmission cycle that contributes to longer movement of HPAI H5N1 virus among waterfowl along specific flyways, they do not appear to be the HPAI H5N1 reservoir and they do not have the capacity to efficiently sustain a year-round transmission.[17, 18, 19, 20]

BOX 1.1

H5N1 HPAI infections in wild birds

The predominant virus clade involved in wild bird events during 2011 was 2.3.2.1 in Bangladesh, Nepal, China, Hong Kong SAR, India and Mongolia. One wild bird event in Cambodia was associated with clade 1.1. The main clades identified in wild birds since 2005 include 2.2 and 2.3.2. Clade 2.2 virus was the predominant clade circulating in wild birds from 2005 to 2010, and was succeeded by clade 2.3.2 from 2010 onwards when the virus was isolated from outbreaks in Japan, the Republic of Korea, Mongolia and the Russia Federation. This clade has also been found during poultry outbreaks in the Republic of Korea, Bangladesh, Japan, China, and the Lao People's Democratic Republic from poultry samples collected via active surveillance.

Though there is limited information to support the role of wild birds/poultry in the introduction and spread of virus clade 2.3 2, it is likely that this virus clade may circulate in poultry and spill over from poultry into wild birds, and is periodically transported by wild birds to other locations. Research has demonstrated that certain wild waterfowl can shed H5N1 HPAI virus asymptomatically for between two to five days, and migration disease ecology research conducted by FAO has characterized distances wild waterfowl can migrate over this time frame. While individual migration flights can be long (hundreds of kilometers), for wild waterfowl to be transmitting virus over such distances it is more likely that this occurs through a 'leap-frog' migration pattern, with concurrent transmission of virus from one bird to many others at stopover sites, and newly-infected birds carrying viruses to the next site. To date, based on sampling of more than 750 000 healthy wild birds, no H5N1 HPAI wild bird reservoir has been found.

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INCREASE IN HUMAN CASES DURING 2011 TO JANUARY 2012

In 2011 to 2012, WHO reported 67 human cases – of which 35 were fatal – in six countries: Cambodia (9 cases; 9 fatalities), Bangladesh (2 cases; 0 fatalities), China (2 cases; 2 fatalities), Egypt (40 cases; 15 fatalities), Indonesia (13 cases; 11 fatalities) and Viet Nam (1 cases; 1 fatality) (see Figure 1.7). Overall, the number of human cases and the number of countries reporting H5N1 infections in humans has increased from 2010 to 2011. In 2011, 62 cases (and 34 fatalities) were reported in comparison to the 48 human cases (and 24 fatalities) in 2010. Viet Nam experienced a decrease in human cases from 2010 to 2011 (from 7 to 1, respectively). As of the end of January 2012, the total number of human cases reported globally was 583 (of which 344 were fatal).

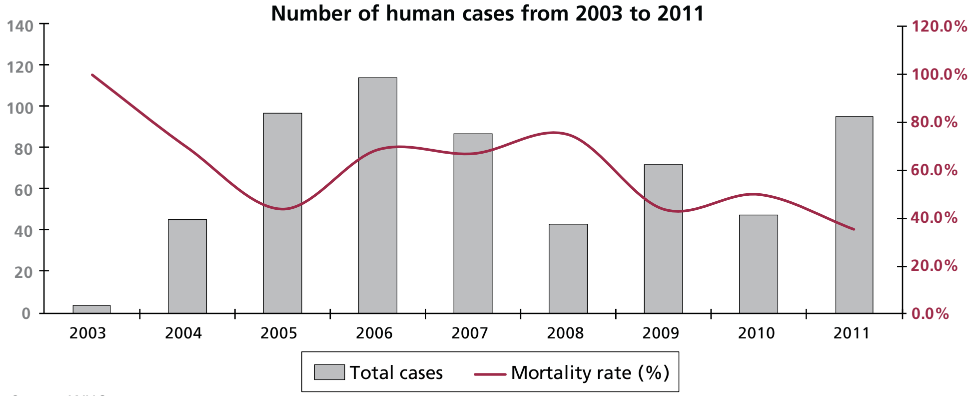
GLOBAL SURVEILLANCE OF H5N1 HPAI AND OTHER ANIMAL DISEASES AT THE ANIMAL/HUMAN/ECOSYSTEM INTERFACE: GLEWS

Surveillance for H5N1 HPAI remains a high priority for FAO at global, regional and national levels. However, it is also a difficult area for national animal health services to maintain investment in because of the costs involved and the declining interest in H5N1 HPAI among animal health field services and poultry producers, in particular, in endemic countries.

The public health and human pandemic threat dimensions of the global H5N1 HPAI enzootic also made such analysis difficult. This situation will remain, as it continues to be difficult to demonstrate the link between poultry health surveillance and human cases. While rare, in some places it has been the occurrence of human cases that has been the sentinel for H5N1 disease in poultry, which has not been identified by farmer reporting systems. In general, as H5N1 HPAI is a relatively uncommon event, active surveillance for disease is relatively inefficient and it is difficult to assess the impact of such surveillance on the overall control of the disease. One of the benefits of active surveillance is that it creates a stronger link between producers and official animal health services, resulting in enhanced farmer awareness and implementation of control measures.

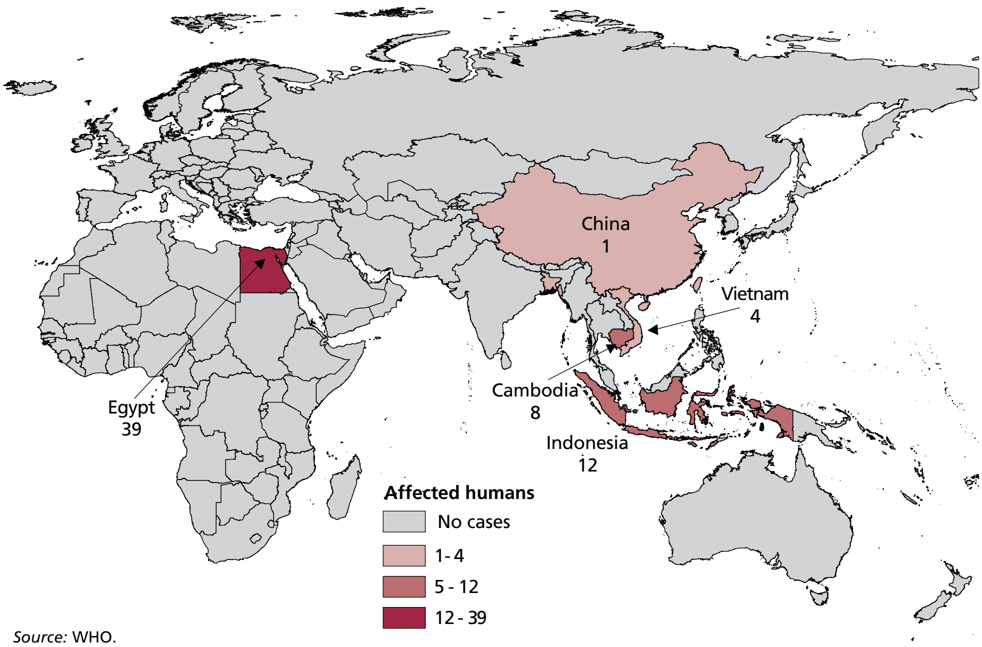
Beyond H5N1 HPAI, emerging and re-emerging animal diseases have increased over the past decades with over 75 percent of emerging diseases affecting humans having their origin in animals (livestock and wildlife). Therefore, managing and coping with the unpre-

FIGURE 1.7
Number of human cases from 2003 to 2011



Source: WHO.

FIGURE 1.8
H5N1 AI virus infections in humans in 2011



Source: WHO.

dictability of infectious disease events is imperative. The increased threats to human, animal and environmental health through existing and emerging pathogens is triggered by multiple, often inter-related factors driven by global development trends (population growth, urbanization, increasing demand for animal products, intensifying farming systems, land use change, increased human mobility, trade liberalization). Traditional approaches to animal disease prevention and control are based on disruption of pathogen transmission. While these have proven to be effective in some cases (e.g. in the global eradication of rinderpest), they have been less successful in others (e.g. the persistence of H5N1 HPAI despite significant elimination efforts). There is increasing recognition that, in isolation, conventional approaches may be insufficient and that the root causes of disease emergence and maintenance need to be addressed for more efficient and sustainable prevention and control of infectious diseases. Therefore, there is a need to broaden the current reactive approaches to health protection to include proactive measures of disease risk mitigation.

During 2011, the GLEWS initiative implemented in partnership by FAO, OIE and WHO, continued to strengthen its capacity in terms of disease hazards analysis, early warning and forecasting. In particular, integrated risk assessment of pathogen transmission at the animal–human interface is a focus of GLEWS analysis activities.

GLEWS activity in 2011 included requests for verification of suspected disease events, disease surveillance reports, epidemiological analysis and specific risk assessments for priority diseases. The joint GLEWS electronic platform[21] is currently hosted by FAO, has

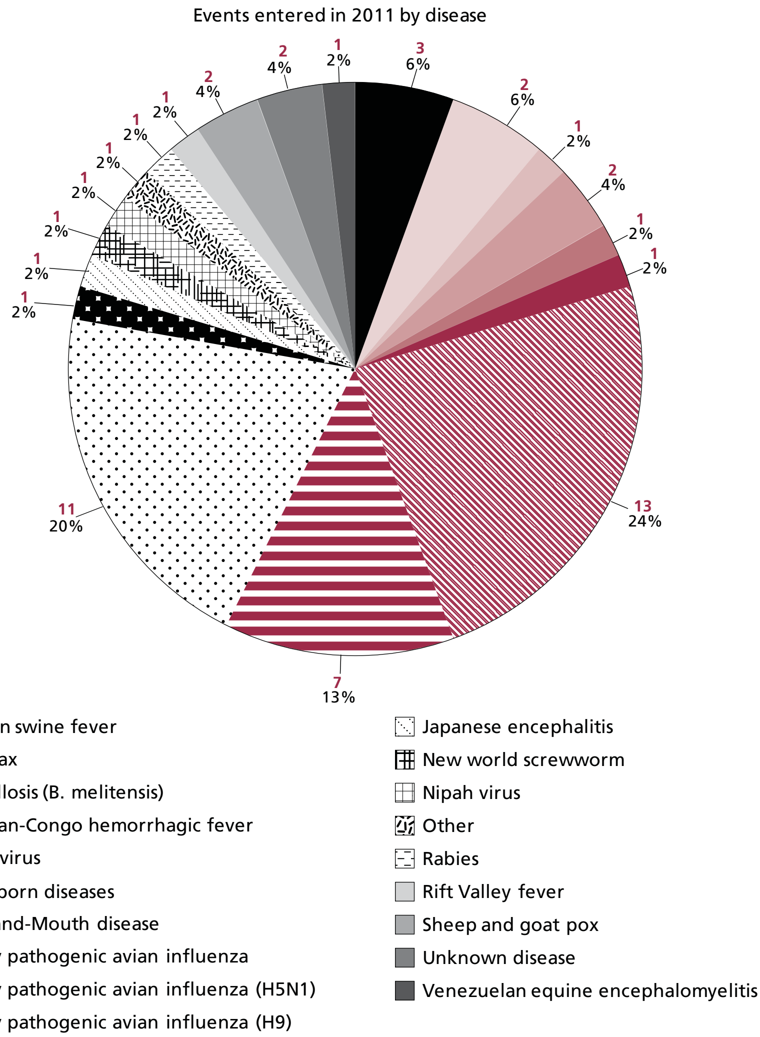
[21] Available at http://www.glews.net/Glews-Platform/

been operational since February 2009 and was designed for data sharing. During 2011, an average of five relevant disease outbreak events per month were investigated jointly by the three partner organizations and information was shared through the GLEWS electronic platform. Some of these events triggered a response from the FAO/OIE CMC–AH or World Health Organization Global Alert and Response (WHO GAR).

The GLEWS platform is password protected to safeguard sensitive or confidential data and provides a disease event management tool that facilitates and links information exchange between the focal points of the three partner organizations. In 2011, a wider and

FIGURE 1.9

GLEWS events entered and verified by FAO/OIE/WHO in the GLEWS platform (January 2011 to January 2012)



Source: FAO GLEWS, 2012.

increased range of diseases was covered in comparison to 2009 and 2010, where H5N1 HPAI reporting was predominant (Figure 1.9). A real-time disease map has been available online since November 2009 and is accessible through the GLEWS website (www.glews.net), showing events that were tracked through the GLEWS platform and officially confirmed or denied by OIE and WHO. Since its launch in March 2009, the number of visitors to the GLEWS website has been steadily increasing to almost 9 000 in December 2010, reaching around 11 000 visitors in January 2011, followed by an average of between 6 000 and over 8 000 visitors a month through January 2012.

Since the beginning of the H5N1 HPAI epidemic in late 2003, the FAO-GLEWS team has been editing, on a weekly basis, a summary of the global H5N1 HPAI situation in poultry and wild birds from official and unofficial sources as well as human H5N1 disease occurrence. A weekly *HPAI Update* describing the main HPAI events and a monthly overview of H5N1 HPAI are published by FAO. They describe global trends, epidemiological analysis and events occurring during the reporting period. For instance, full access to animal data provided by OIE and FAO has been available to WHO to assess the risk of people contracting H5N1 infection.

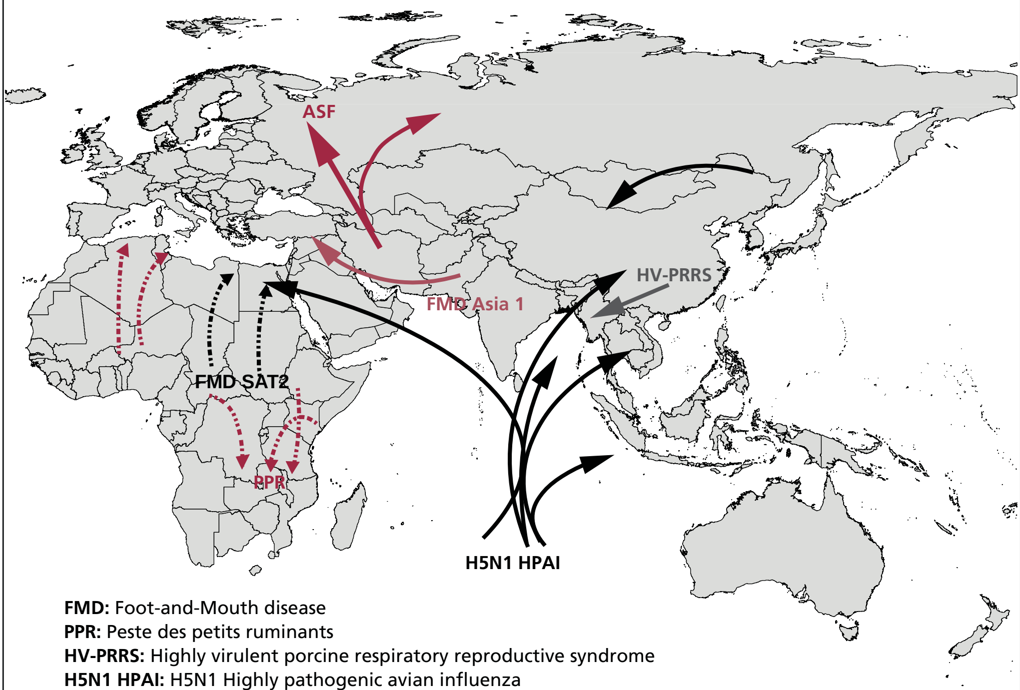
H5N1 HPAI continued to be a major concern in 2011, in particular, in endemic countries, but other emergent diseases are monitored regularly by GLEWS. During 2011, other animal diseases also continued to spread in different regions of the world, disrupting livestock production, rural economies and people's livelihoods and food security. This spread has been due largely to the limited capacity of veterinary services to contain animal diseases in endemic settings, and to disease drivers such as high intensification of animal production, increased trade of animal and animal products and intensified contact between animal, human and wildlife populations. This significant flare-up of disease events in 2011 include: the continued and uncontrolled spread of African swine fever (ASF) in Eastern Europe and the Russian Federation, FMD spread in North Africa (type SAT 2) and Central Asia (type Asia 1), PPR moving through Eastern and North Africa (Algeria and Tunisia), and highly virulent porcine reproductive and respiratory syndrome (hvPRRS) in Southeast Asia (Figure 1.10). During 2011, a significant emergence of a new disease, Schmallenberg virus disease (SVD), is occurring in Europe causing congenital malformations in domestic ruminants. SVD belongs to the *Bunyaviridae* family, within the *Orthobunyavirus* genus and the spatial and temporal distribution suggests that the disease is transmitted by insect vectors and then vertically, in utero.

PROSPECTIVE FOR 2012

Globally, H5N1 HPAI in poultry and H5N1 human cases continue to be a global threat for poultry, wild birds and human populations. H5N1 HPAI still present a seasonal pattern as seen in previous years in endemic countries, which is reflected in increased of cases in poultry and humans from October each year until April. Emergent virus H5N1 clade (sub-strain) 2.3.2.1 remains circulating in eastern Asia and the Ganges Delta threatening wild birds and poultry populations.

Other TADs such as ASF will continue to spread to the western part of the Russian Federation in areas close to European Union countries and, potentially, to eastern borders with China, threatening China's and Southeast Asia's swine population. This is a disease for which there is no available vaccine. Other emergent diseases in swine will continue to

FIGURE 1.10
Major animal disease threats (January 2011 to January 2012)



FMD: Foot-and-Mouth disease
PPR: Peste des petits ruminants
HV-PRRS: Highly virulent porcine respiratory reproductive syndrome
H5N1 HPAI: H5N1 Highly pathogenic avian influenza

Source: FAO GLEWS, 2012.

expand geographically into new areas such as has been observed during the last five years with hvPRRS spreading from China to countries in Southeast Asia.

Some countries in North Africa and the Middle East have been facing civil instabilities since 2011 and it is expected that the spread of TADs including H5N1 HPAI, FMD and PPR will expand to geographical areas where these diseases have been absent or not reported regularly. The FMD situation will continue to be fluid in Egypt, Libya and the Middle East with three different strains detected at the end of 2011 and the beginning of 2012 (Type A O5 Islamic Republic of Iran, Type A African origin and SAT 2 related to FMD SAT 2 strains detected in Sudan). There is a significant risk that other viruses circulating in eastern Africa readily find the way to Egypt/North Africa causing regional epidemics of FMD. In Libya, for instance, outbreaks of FMD types O and the new SAT 2 are spreading within the country, and FMD Asia 1 has been spreading since 2009 from Afghanistan, Pakistan, and Islamic Republic of Iran and recently, in 2012, into Turkey. FMD types will continue to spread. FMD types Asia 1 and FMD Sat 2 are spreading through Central Asia (Afghanistan, Pakistan, Turkey) and North Africa (Libya, Egypt) and the Middle East (Bahrain), respectively from endemic areas. Understanding of livestock trade routes and factors triggering incursions of new types in endemic areas is of paramount importance since vaccination against FMD covers only some circulating types with serious implications for routine vaccination campaigns against known types. Surveillance efforts need to be enhanced in endemic areas to detect incursions of new types causing large epidemics affecting livestock, food security and livelihoods. The absence of a vaccine protecting against all FMD types is an important gap in the control of FMD since vaccines need to be regularly updated to guarantee the efficacy of vaccination programmes against all endemic types circulating or to face incursions of new types into this endemic areas.

In Africa, PPR distribution includes the sub-Saharan countries that lie between the Atlantic Ocean and the Red Sea where the disease has been recorded in almost every country. However, PPR is rapidly expanding beyond its traditional boundaries and now poses a major threat to northern and southern Africa and Europe. On its spread south, PPR, in recent years, has already become endemic; first in Kenya and then in the United Republic of Tanzania, sometimes without the presence of overt disease. An incursion of PPR in 2008/09 in Morocco was successfully contained through rigorous blanket vaccination of the entire national small ruminant flock, suggesting that PPR control presents a viable technical target. These incursions into northern Africa have been followed by the very recent findings of PPR sero-positive animals in Algeria in early 2011, and in Tunisia in early 2012.

The emergence of rabies from endemic areas into new areas and livestock species from wildlife reservoirs in some regions have to be carefully considered since this disease continues to be the most relevant zoonoses in terms of humans affected and deaths. Wildlife (e.g. bats, foxes) play an important role in rabies transmission to livestock. Increased encroachment of domestic and wildlife populations is facilitating contact rates between species compartments and the emergence of rabies in some regions. However, traditional canine rabies remains the most important mechanism for transmission of rabies from animals to humans.

Vector-borne diseases (VBD) are expanding and will continue to expand their geographical distribution associated with climate change and global warming effects. The geographical expansion of Bluetongue serotypes into northern regions of Europe during recent years and the emergence and spread of the new SVD detected and spread within Western Europe are clear examples of this new VBD dynamic. Geographical expansion of VBDs and adaptation of pathogens to new hosts or vectors need to be closely monitored in all regions for the serious implications of VBD such as West Nile virus (WNV) and Congo-Crimea haemorrhagic fever (CCHF) on public health.

Chapter 2
The FAO One Health portfolio

Since the HPAI expansion began in Asia in late 2003, FAO has been playing a key role in the global response to the prevention and control of HPAI and is now repositioning itself as a main driving force in the broader field of prevention, detection, control and response to other high impact emerging and re-emerging infectious diseases. The following chapter provides a summary of the FAO One Health portfolio as of December 2011 and the FAO One Health AP funding requirements[22] (as of January 2012 to support 2012–2013 activities).

OVERVIEW OF EMERGENCY CENTRE FOR TRANSBOUNDARY ANIMAL DISEASES (ECTAD) PORTFOLIO

FAO commenced its HPAI global response in 2004, initially in Asia.[23] However, with the rapid spread of HPAI to other parts of Asia, Africa, and Central and Eastern Europe, FAO and OIE came together and developed the joint *FAO/OIE Global Strategy for the Progressive Control of H5N1 HPAI in 2005*, which was revised in 2007. To implement the strategy, FAO developed a global programme[24] to address the required immediate and short-term interventions, while improving capacities for longer-term sustainable approaches to eliminate H5N1 HPAI from poultry. The global programme was implemented by FAO's ECTAD established in 2004. In addition to 165[25] donor-funded HPAI projects, the ECTAD programme portfolio also includes 48 projects related to other TADs (see Table 2.1). Of the 165 HPAI projects, 21 projects were still active at the end of December 2011, 60 percent of which are in Asia. Out of the 48 TAD projects, 20 projects were active at the end of December 2011, addressing key TADs (ASF, anthrax, brucellosis, rabies, Rift Valley fever [RVF], rinderpest, PPR, and Ebola-Reston virus [ERV][26]), with 35 percent of those in the Asia region.

HPAI remains a high priority. FAO's eight-year collaborative HPAI global programme has contributed significantly to limiting the impact of the disease, establishing stronger national systems and strengthening regional coordination for disease preparedness, prevention and control. While sustained coordinated action has progressively reduced the number of

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[22] For more information see http://www.fao.org/docrep/meeting/021/ma145e.pdf

[23] *FAO recommendations on the prevention, control and eradication of highly pathogenic avian influenza (HPAI) in Asia* (available at http://www.fao.org/docs/eims/upload//246982/aj126e00.pdf).

[24] Global Programme for the Prevention and Control of H5N1 Highly Pathogenic Avian Influenza, 2006-2008. FAO regularly updates this programme based on knowledge advancements in science, socio-economics and policy (2008 version is available at ftp://ftp.fao.org/docrep/fao/010/ai380e/ai380e00.pdf).

[25] The total number of HPAI projects has decreased since the release of the last global report. This decrease occurred as a result of the project mapping exercise that focused on revising the thematic scopes of projects and tagging these against either HPAI or TADs. Consequently, three of the former HPAI projects were reclassified as TAD projects.

[26] There were also a number of projects on pandemic (H1N1) following the 2009 outbreaks.

TABLE 2.1
Overview of the ECTAD One Health portfolio

FAO ECTAD portfolio as of December 2011	HPAI	Other TADs
Total active projects	*21*	*20*
Asia	17	6
Central Asia	0	2
Global	2	1
Interregional	2	6
Africa	0	4
MENA	0	1
Latin America	0	0
Total closed projects	144	28
Total projects	165	48
Total budget (2004-2011) in US$	**322 274 745**	**73 749 833**

countries affected by HPAI there is still a need to address the elements that inhibit progress towards disease control, prevention and elimination in the poultry sector in endemically infected countries and regions. While a large amount of disease work will remain prioritized on addressing HPAI in endemic countries, many other high impact zoonotic and TADs need to be addressed, too. The current ECTAD project portfolio reflects today's global need for a balanced combination of TAD and HPAI projects.

FUNDING STATUS

During the period 2004 to 2011, FAO and its partners have mobilized a total of US$396 million towards HPAI and TAD projects (see Figure 2.1). Of this grand total, a little over US$322 million were mobilized towards HPAI projects in over 95[27] countries for H5N1 HPAI preparedness, prevention and control. The FAO HPAI global programme funding peaked in 2007 after which it has been on a declining trend, both in terms of new projects and donor funding. During the same period, just under US$74 million were mobilized toward TAD projects in 61[28] countries. The TAD funding reached its highest levels in 2009[29] (US$26.53 million), to then dropped by more than 50 percent (US$10.99) by 2011.

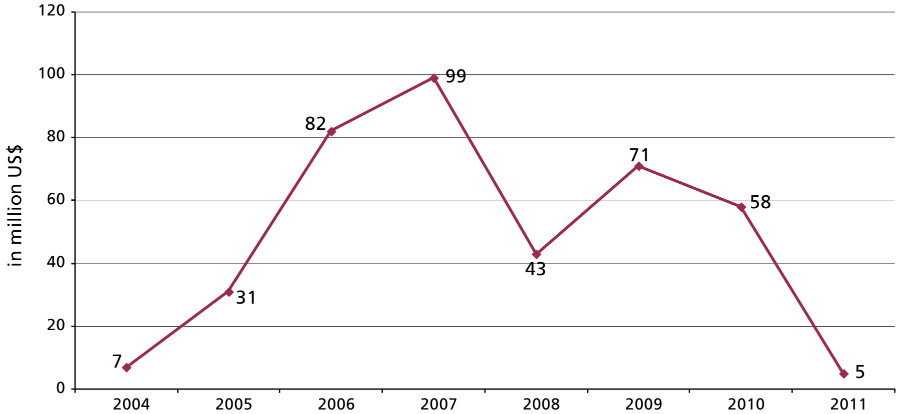
The trend in HPAI and TAD funding was due, in part, to the broader contextual changes taking place in the thinking within the international animal health and donor community on the need to move away from disease-specific interventions to a more holistic and integrated approach to building sustainable animal health systems at country, regional and global levels. FAO has been working along this approach, and in 2009 published

[27] These include countries that are direct recipients of funding and countries that are beneficiaries of global and interregional projects.

[28] These include countries that are direct recipients of funding and countries that are beneficiaries of global and interregional projects.

[29] The pandemic (H1N1) outbreaks worldwide during 2009 led to further recognition of the need to build strategically on lessons learned from the responses to H5N1 HPAI and to apply them to other TADs and EIDs.

FIGURE 2.1
Total funding per year (HPAI and TADs) 2004–2011



Note: The figure represents actual project approvals and budget openings per year.
Source: Food Chain Crisis Emergency Management Unit Report: December 2011.

Highly pathogenic avian influenza and beyond: FAO's response – towards one world, One Health.[30] Furthermore, FAO developed a strategic AP (2011-2015)[31] entitled, Sustainable animal health and contained animal-related human health risks – in support of the emerging One-Health agenda which was endorsed by FAO's programme committee in March 2011 and now constitutes the overall programmatic umbrella for the ECTAD work.

As a result, the current ECTAD project portfolio presents a balanced combination of TAD and HPAI projects, each constituting approximately 50 percent of the overall animal health programme.

DONORS

The HPAI global programme is financed by a total of 35 donors, of which 24 are government contributors, and the remaining 11 donors are mostly multilateral organizations.

The United States of America is the largest donor, contributing almost 50 percent (49.6 percent) of the total FAO HPAI global programme portfolio, with a total budget of US$159.92 million as of December 2011. The United States of America is followed by Sweden (US$23.66 million), Australia (US$16.38 million), the European Union (US$14.15 million) and Japan (US$13.65 million). Table 2.2 provides details of all donors funding the HPAI portfolio and their contributions.

By comparison, the ECTAD TAD portfolio is supported by 12 donors equally distributed between multilateral organizations and governments. The United States of America is the largest donor contributing US$26.2 million (more than a third at 36 percent) of the overall portfolio, followed by the European Union (US$22.2 million). The Table 2.3 provides details of donor contributions to the TAD portfolio.

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30 Available at http://www.fao.org/ag/againfo/resources/en/publications/agapubs/HPAI_and_beyond.pdf

31 Available at http://www.fao.org/docrep/meeting/021/ma145e.pdf

TABLE 2.2
Total budget per donor in the HPAI portfolio as of December 2011

	Donor	Funding (million US$)
1	ADB	11.14
2	AU-IBAR	0.24
3	Australia	16.38
4	Bangladesh	1.08
5	Belgium	2.83
6	Canada	9.92
7	Common Humanitarian Fund (CHF) Sudan	0.30
8	China	0.50
9	European Union[1]	14.15
10	FAO	9.65
11	France	6.74
12	Germany	9.53
13	Greece	0.19
14	ILRI	0.26
15	Ireland	0.32
16	Italy	0.28
17	Japan	13.65
18	Jordan	0.05
19	Nepal	2.39
20	The Netherlands	0.63
21	New Zealand	0.34
22	Norway	3.70
23	UNAMA	0.03
24	Organization of the Petroleum Exporting Countries (OPEC) Fund	0.70
25	Saudi Arabia	1.00
26	Spain	1.68
27	Sweden	23.66
28	Switzerland	3.70
29	UNDGO	0.93
30	United Nations Development Programme (UNDP)	0.77
31	The United Kingdom of Great Britain and Northern Ireland	10.24
32	The United States of America	159.92
33	UNJ	5.01
34	Viet Nam	1.05
35	WB	9.31
	Total	**322.27**

[1] This funding does not include funding for FAO's activities under The European Commission for the Control of Foot-and-Mouth Disease (EUFMD). (For more information on EUFMD see http://www.fao.org/ag/againfo/commissions/eufmd/en/).

TABLE 2.3
Budget per donor in the TAD portfolio as of December 2011

	Donor	Funding (Million USD)
1	African Development Bank	0.66
2	Australia	2.52
3	European Union	22.22
4	FAO	5.91
5	The Republic of Korea	2.61
6	Netherlands	1.25
7	CRDF	0.60
8	Spain	1.70
9	Sweden	1.83
10	The United States of America	26.91
11	UNDP Administered Donor Joint Trust Fund (UNJ)	5.77
12	UNOCHA	1.77
	Total	**73.75**

GEOGRAPHIC PRIORITIES

The HPAI/TAD funding has been mobilized for a range of operational and technical activities, particularly for developing and strengthening of veterinary structures, early warning, efficient detection and rapid response, in various geographic areas. The overall number of reported outbreaks/cases of H5N1 HPAI worldwide increased in 2011 compared to the same period in 2010, partly due to reporting from previously infected countries particularly associated with wild bird events. There was a general decrease in outbreak numbers at the country level during 2011, with the exception of Japan, the Republic of Korea and Bangladesh where increases were observed (see Chapter 1, Table 1.1). In Bangladesh, incidence appears to have increased considerably during 2011, where a five-fold increase in outbreak numbers was observed. The disease remains entrenched in several parts of Asia; consequently, Asia receives the most donor funding (see Figure 2.2).

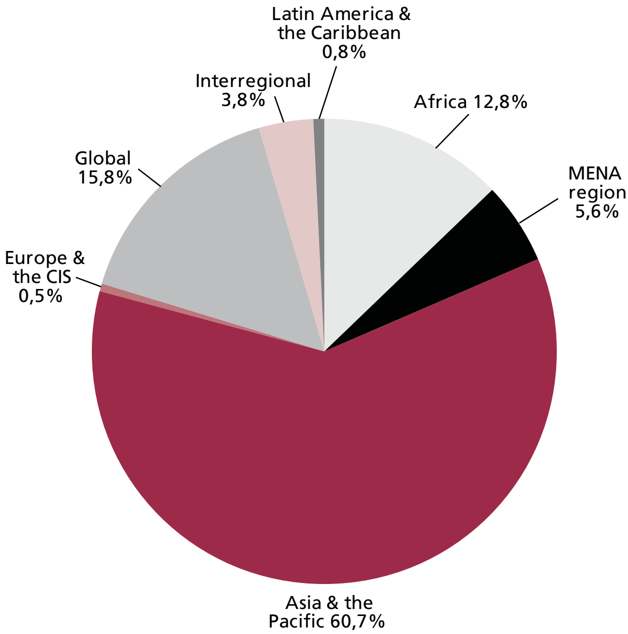
The Asian region as a whole received US$195.5 million during the period 2004–2011, accounting for 60.7 percent of total HPAI donor funding for implementation of national and regional projects.

Global activities[32] constitute 15.8 percent (US$50.8 million) of the total donor funding on HPAI, followed by the African region, which received 12.8 percent (US$41.3 million) of HPAI funding for implementation of national and regional projects.[33] The Middle East and

[32] Global projects are projects that cover a global geographical area.

[33] These figures reflect an overall US$8.8 million decrease in funding for Africa since the Fourth Report January to December 2010: Global Programme for the Prevention and Control of Highly Pathogenic Avian Influenza available at http://www.fao.org/docrep/014/i2252e/i2252e00.pdf).

FIGURE 2.2
Donor funding for HPAI by region 2004–2011



North African Region (MENA) received 5.6 percent (US$18.3 million) of total HPAI funding. Cumulatively, Europe and the Commonwealth of Independent States (CIS),[34] Latin America and the Caribbean (LAC) and interregional projects have received a total of US$16.3 million in donor assistance (5.1 percent of the overall HPAI portfolio).

Similar dynamics can be observed for TAD funding in terms of geographic distribution, with Asia being the major recipient of the overall TAD funding (35.4 percent of the portfolio at US$26 million). In addition, Asia received an almost equal share for interregional projects (34.9 percent at US$25.7 million). The African region received 15.3 percent of the overall TAD portfolio (US$11.3 million) in donor assistance, followed by funding for global projects (7.9 percent of the portfolio at US$5.8 million). Together, the projects operated in Europe (including CIS), MENA and LAC regions, received 6.5 percent of the overall TAD funding (US$4.9 million). Figure 2.3 provides details on the donor funding for TADs by region.

In terms of country allocation of donor funds, Figure 2.4 provides details of the top 11 recipients of HPAI funding. Nine of the countries are in Asia and the remaining two are Chad and Egypt. Three of the top four countries (Indonesia, Vietnam and Bangladesh) are endemic countries where emerging and re-emerging high-impact diseases are considered likely, and in Egypt the ongoing HPAI situation remains unstable. The total budgets for these 11 countries comprise nearly 49 percent (US$157 million) of the total HPAI funding.

[34] CIS includes Armenia, Azerbaijan, Belarus, Kazakhstan, Kyrgyzstan, Republic of Moldova, the Russian Federation, Tajikistan and Uzbekistan.

FIGURE 2.3
Donor funding for TADs by region 2006–2011

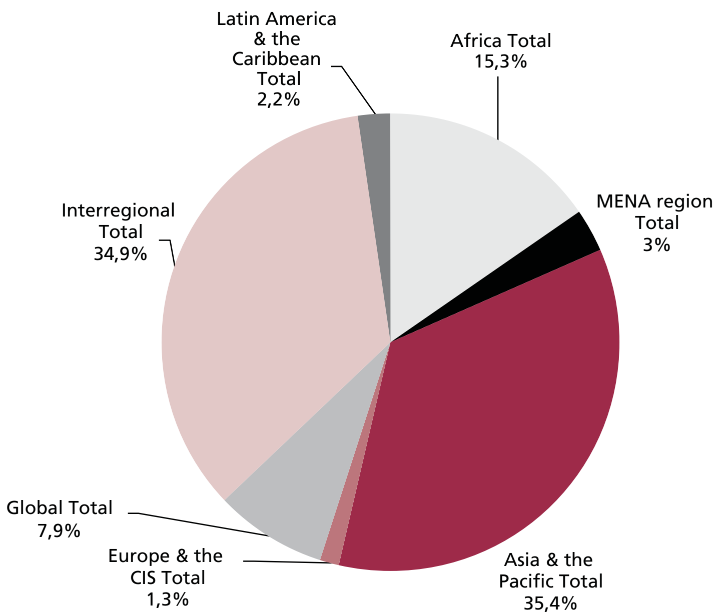
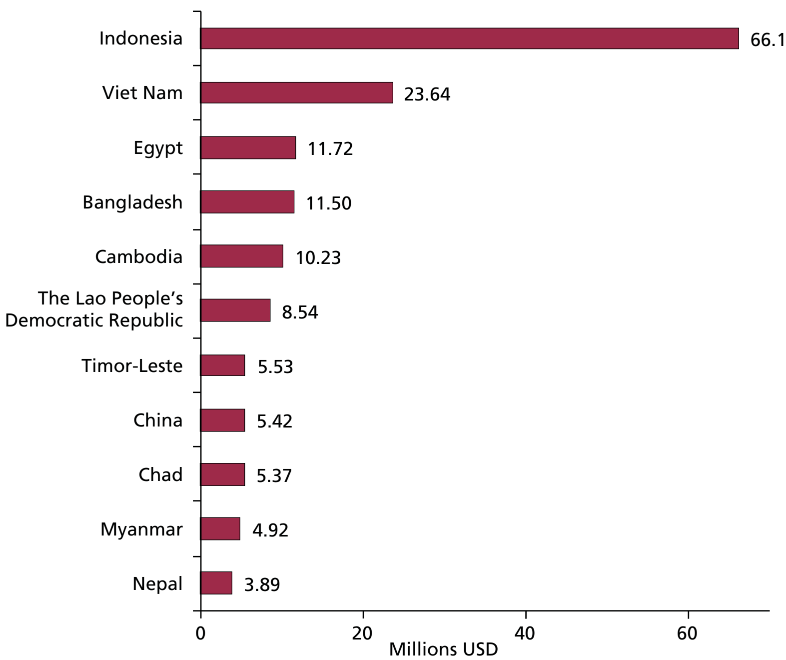


FIGURE 2.4
Total HPAI funding at country level during 2004–2011



The country distribution of the TAD portfolio presents a slightly different pattern with the main recipients being almost equally distributed in Asia (five countries) and in Africa (four countries). The remaining main recipient countries are the CIS countries, Georgia and Armenia. The total funding for the top 11 countries amounts to nearly 26 percent (US$19 million) of the overall TAD portfolio (see Figure 2.5 for details).

LEVELS OF INTERVENTION

The country focus has been at the heart of the FAO global programme and has proved crucial to the success of the FAO response to HPAI. National activities have been essential in building and strengthening basic animal health related capacities in the affected countries.

Currently, the simultaneous interventions at the global, regional and country levels provide greater efficiency and effectiveness of programming and implementation of HPAI prevention and control, as well as allowing for a more integrated response that is in line with the One Health agenda.

While 2011 prioritized focus at the local and national levels, regional and global levels also needed attention within the HPAI and TAD portfolio. The transboundary nature of HPAI and other high-impact diseases requires continued and improved cross-border cooperation and collaboration in disease intelligence, detection, control and prevention. Within the HPAI portfolio, as of December 2011, 58 percent of projects have been implemented at the national/country level; 26 percent at the regional/interregional level; and 15.8 percent at the global level (see Figure 2.6).

FIGURE 2.5
Total TAD funding at country level during 2006-2011

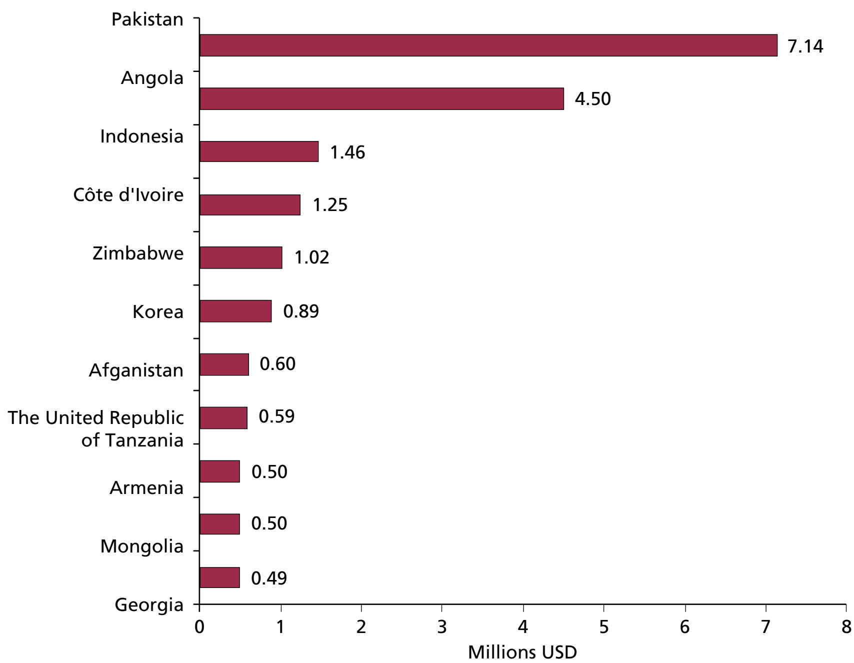
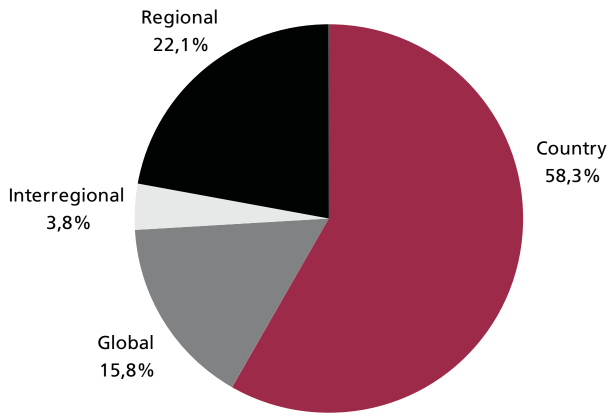
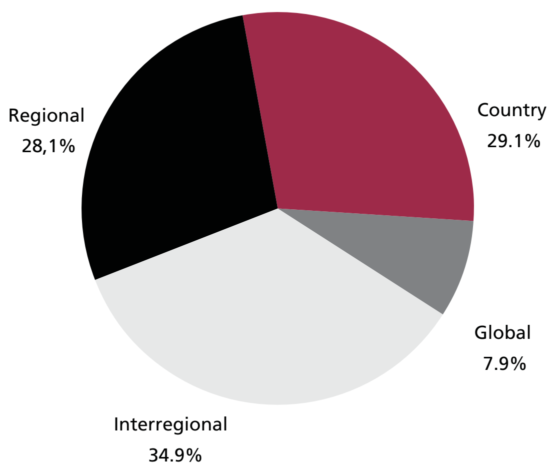


FIGURE 2.6
Level of intervention for the HPAI portfolio (2004–2011)[1]



[1] Based on project funding (US$) per level of intervention (at country, regional, interregional or global levels).

FIGURE 2.7
Level of intervention for the TAD portfolio (2006–2011)



For the TAD portfolio (see Figure 2.7), the trend is clearly defined by the Interregional projects amounting to approximately 35 percent (US$25.7 million) of the overall TAD funding, followed by the country project allocations of 29 percent (US$21.5 million).

LONGER-TERM HOLISTIC MULTIDISCIPLINARY APPROACH TO HPAI AND HIGH-IMPACT ANIMAL AND ZOONOTIC DISEASES

The projects introduced in the immediate aftermath of HPAI outbreaks in early 2004 were mainly implemented to address the pressing concerns of controlling the HPAI outbreaks in the affected countries. While the short-term response focus is increasingly moving towards a longer-term sustainable approach, the declining global programme funds and the difficulty in engaging donors on projects on a longer-term basis present significant challenges.

In terms of the multidisciplinary aspects of the HPAI projects, the ongoing portfolio is still focused on the veterinary disciplines of surveillance, response, strengthening of veterinary services and laboratory capacity. However, following the Second Real-Time Evaluation of FAO's work on Highly Pathogenic Avian Influenza (RTE 2)[35] recommendation to develop a more integrated and multidisciplinary approach, there is a greater integration of other areas of work such as biosecurity, socio-economic and market analysis, communication, public/private partnerships and wildlife aspects into the HPAI and TAD projects.

ONE HEALTH STRATEGIC AP: CURRENT AND FUTURE FUNDING REQUIREMENTS

One Health is a collaborative, cross-sectoral, multidisciplinary approach to address health threats and reduce risks of existing, emerging and re-emerging infectious diseases. More specifically, it acknowledges the animal-human-ecosystem interface, and places disease dynamics into the broader context of agriculture and socio-economic development and environmental sustainability. FAO's strategic AP (2011–2015) recognizes the animal-human-ecosystem interface. Its activities contribute to the prevention and containment of major animal diseases and related human health risks globally as well as increasing sustainable livestock production. It emphasizes FAO's comparative advantage in taking a broad, multidisciplinary approach to problem solving, and in building on investments and lessons learned from the HPAI programme through cooperation with national governments, subregional, regional and global organizations, and with donor agencies. The plan also proposes to enhance knowledge on how to strengthen global animal health management and engage countries in a long-term development towards prevention, control and response to animal and public health risks attributable to zoonoses and priority animal diseases.

Once endorsed in March 2011, FAO began implementing the strategic AP in July 2011 at the local field level, with further development underway in 2012 at local, regional and global levels. Initially, implementation began by mapping all ongoing projects on HPAI and other high-impact diseases (transboundary and zoonotic) against the five technical areas of work of the plan. New projects are integrated as they are funded. Available project funds in July 2011 (US$38.4 million) and new funding (US$37.8 million) since July 2011, for a total of US$76.2 million have allowed continued HPAI activities, as well as the initiation of some priority activities at global and country levels. Incremental resources of US$117.6 million (AP total of US$193.8 million with US$76.2 million already received) will be required to cover all activities of the AP over the projected five-year period. Of this, US$51 million

[35] Second Real-Time Evaluation of FAO's work on Highly Pathogenic Avian Influenza (available at http://www.fao.org/docrep/meeting/019/k8501e.pdf).

TABLE 2.4
Gap in funds for the six priority areas identified for 2012–2013

Priority areas	Funding requirements (US$ million)
Priority 1 HPAI	15.0
Priority 2 Progressive control pathway for priority diseases	11.5
Priority 3 Emergency response capacity	4.0
Priority 4 Understanding drivers of diseases	8.0
Priority 5 Disease intelligence and early warning	4.5
Priority 6 Disease impact and socio-economic analysis	8.0
Total funding needed 2012–2013	**51.0**

would be required to support and focus work for 2012–2013 within the six priority areas[36] of the AP indicated in Table 2.4.

The key outcomes of the AP are expected to be reduced incidence of animal diseases and the associated human health risks as well as improved preparedness for, and effective response to, food and agricultural threats and emergencies. These outcomes will result in improved livelihoods and public health, reduced poverty and enhanced food security for the poor communities of today's global society, thereby contributing significantly to the achievement of key FAO strategic objectives and the Millennium Development Goals (MDGs).

PARTNERSHIPS WITH GLOBAL AND REGIONAL PARTNERS

The activities of the HPAI global programme and all other animal health activities in this report are carried out in conjunction with partner organizations and donors. These activities are linked to the FAO strategic framework which is detailed in The Director General's Medium Term Plan 2010–13 and its biennial PWB. Specifically, the activities of the HPAI programme and the AP contribute to SO-B of the plan (increased sustainable livestock production) and SO-I (improved preparedness for, and effective response to, food and agricultural threats and emergencies). Activities also support other FAO strategic objectives related to food safety, fisheries, natural resources management and gender, and the Millenium Development Goals (MDGs) addressing global partnership, hunger and poverty, and natural resource management.

The AP calls for cross-sectoral and multidisciplinary collaboration between animal, human and wildlife health sectors. FAO has a variety of mechanisms for interaction with partner organizations, which are utilized in the HPAI global programme and the AP. In this

[36] Given the wide range of activities supporting the AP and the limited funding resources currently available, six broad priority actions have been identified for the first phase of the AP (2011–2013). Identification of these priority areas takes into account the immediate capacity requirements and needs for better management of animal-associated health threats at global, regional and country levels, as well as FAO's mandate and comparative advantages. As the AP progresses and more funding becomes available other noteworthy activities will be undertaken to complement the ongoing activities in order to achieve the goals and objectives of the AP by 2015.

respect, FAO is working, in close collaboration with its global partners such as OIE and WHO, to incorporate these dimensions of animal, ecosystem and public health protection, introducing a broader scope in disease risk analysis and management. Together with UNEP, FAO is co-convener of the Task Force on Wildlife Diseases. Regular partnership consultations and collaborative discussions take place on a consistent basis via multiple specific meeting venues in order to better coordinate, decrease redundancies and facilitate partnership efforts. Collaborative efforts are fostered particularly through work and activities under the following initiatives:

- the Tripartite FAO/OIE/WHO agreement to advance the One Health agenda at the global level;
- GF-TADs, a shared FAO/OIE initiative, to target TADs and major zoonoses;
- GLEWS, a joint FAO/OIE/WHO tool, to provide alerts and early warning messages with forecasting and disease intelligence support. GLEWS work relies on livestock and animal health risk mapping facilities, disease information software packages and global level data repositories, shared with OIE and WHO;
- CMC-AH to coordinate interventions in response to TAD outbreaks, providing emergency response and initial risk assessment with identification of immediate strategies for disease control and prevention; and
- OFFLU to support laboratory and field surveillance programmes that manage data on animal pathogens and integrate other relevant disease information sources at national, regional and global levels.

In addition to these coordination platforms, other initiatives are now encompassed in the FAO AP to foster collaboration and partnerships with OIE, WHO and others. These include, but are not limited to:

- The Emerging Pandemic Threats (EPT) Program, a USAID-funded initiative established in 2009 to expand upon the lessons learned in combating the global H5N1 HPAI pandemic. Within this initiative two programmes support specific activities of the AP:
  - i EPT plus; a new joint programme that will reflect the honing of FAO's surveillance of influenza viruses over the years, which now increasingly focuses on monitoring for pathogens with pandemic potential in the mixing of crowded human populations with animals and wildlife.
  - ii IDENTIFY; a joint programme established to address gaps and strengthen collaboration in human and animal health laboratory and surveillance activities. This includes: continuing facility upgrading, training and collaboration between regional and international reference laboratories for diagnostics and quality assurance, increased cooperation between human and animal surveillance systems in analysing data, timely sharing of comparable epidemiological and pathogen data and effective strategies for improving national, regional and community level pandemic preparedness and response.
- A European Union-funded project highly pathogenic and emerging (or re-emerging) diseases (HPED) provides funding to strengthen animal health and human health services and to develop regional efforts to combat H5N1 and other diseases in South Asian Association for Regional Cooperation (SAARC) and Association of Southeast Asian Nations (ASEAN) countries.

- A collaborative effort with AU-IBAR and OIE is related to improving veterinary governance to support regional economic communities such as East African Community (EAC); Economic Community of West African States (ECOWAS); the Intergovernmental Authority on Development (IGAD); the South African Development Community (SADC); and the Union du Maghreb Arabe (UMA) at the country level. This effort enables national veterinary services in Africa to enhance institutional capacity for animal health policy and strategy formulation and implementation based on clear governance principles, and to use socio-economic data to leverage resources and to target interventions.
- Information regarding other collaborative programmes is available upon request (e.g. the Australian Partnership on Global Animal Health and Biosecurity Initiatives; or support for the One Health initiative in sub-Saharan Africa and Bangladesh through an Irish trust fund project). Information is also available upon request regarding ongoing efforts to secure funding or partnerships with various private sector groups, foundations, academia and others.

Chapter 3
H5N1 HPAI in endemic countries

INTRODUCTION

FAO, working with national authorities in endemic countries, has developed a framework for each country, tailored for local differences in the poultry sector, the stage of development of the H5N1 HPAI programme, socio-political characteristics as well as the strengths and weaknesses in both the public and private sectors. Each framework comprises a mix of measures aimed at outbreak control and responses, information gathering and analysis, disease prevention and risk reduction. The approaches to meeting each endemic country's goals are based around progressive control. Each of the identified constraints to the control and prevention of HPAI are addressed, but improvements will be necessarily gradual. The road to overcoming these constraints is long and governments and donors must understand that there are no quick fixes to the various institutional and structural issues that led to the disease becoming endemic in the first place. In the previously mentioned Fourth Report January-December 2010: Global Programme for the Prevention and Control of Highly Pathogenic Avian Influence, FAO provided in-depth information on a variety of technical issues related to HPAI in endemic countries. Additional details can be found in the FAO 2011 publication, *Approaches to controlling, preventing and eliminating H5N1 highly pathogenic avian influenza in endemic countries.*[37]

Additionally, over the last few years FAO's role and priority in endemic countries has evolved from predominantly emergency response to long-term capacity development to improve technologies and proficiencies in field and market surveillance, mechanisms for early detection and timely response in HPAI-infected and at-risk countries. This transition provided an opportunity to reflect on the work done so far in HPAI control, especially in endemic regions, and to identify achievements, success stories, challenges, lessons learned and, most importantly, their impact. FAO launched an initiative in late 2011 and early 2012 to gather information from a large group of international and national experts involved in HPAI control in the FAO ECTAD Regional Programme for Asia, with the broad objective of taking stock of the HPAI programme between 2005 and 2011. The report, entitled Lessons from HPAI, is expected to be published by the last quarter of 2012. Provisional summaries with salient details are available in FAO-RAP bulletins.[38] Based on this reflection and analysis, as well as similar analysis in Egypt, the following chapter is intended to provide a broad update on main issues arranged thematically. This update is followed by specific endemic country snapshots, which identify the major challenges and propose considerations for the future. The chapter is not intended to be an exhaustive listing of activities and outputs;

[37] Available at http://www.fao.org/docrep/014/i2150e/i2150e.pdf

[38] Available at http://www.fao.org/docrep/016/an414e/an414e.pdf and http://www.fao.org/docrep/016/an413e/an413e.pdf

instead, it provides highlights of the eight-year effort against HPAI in endemic areas. The aim is to produce a better understanding for the application of lessons learned in order to build upon successes and develop knowledge for the future.

2011 SYNOPSIS OF ENDEMIC COUNTRIES

Where we are

Since the emergence of zoonotic H5N1 HPAI, the disease situation has evolved considerably. FAO's collaborative HPAI global programme has contributed significantly to limiting the impact of the disease, establishing stronger national systems as well as strengthening regional coordination for disease preparedness, prevention and control. With the continuous support of the international donor community, national governments, regional and international organizations, development agencies and international development banks, sustained coordinated action has reduced the number of countries affected by H5N1 HPAI. The disease has now been eliminated from most of the countries in the world. This result was achieved by assisting national veterinary services to develop preparedness and contingency plans; improving surveillance systems; acquiring laboratory resources and disease diagnosis capacity; developing response capabilities; developing advancing communication and awareness; and promoting biosecurity along the value chain. And while much progress has been made, HPAI remains a significant threat to the poultry industry, destabilizing agriculture in countries where backyard farming of domestic ducks is common, impacting the food security and livelihood of millions of people and maintaining the potential for emergence of a pandemic human influenza. The pandemic potential is an extra concern given the mounting evidence of increasingly active bi-directional swine-human virus genetic exchange in the form of reassortments of H3 and H1 viruses. It appears that 2011 also marked an increase of avian origin H5N1 and H9N2 virus segments into the swine gene pool.

Currently, H5N1 HPAI is endemic in Bangladesh, China, Egypt, Indonesia, Viet Nam and large parts of eastern India. A number of countries in Asia, including the Lao People's Democratic Republic, Cambodia, Myanmar and Nepal, also experience regular sporadic outbreaks. Since 2010, sporadic poultry outbreaks have also occurred in Eastern Asia (Japan and the Republic of Korea). The last newly infected country was Bhutan in February 2010. While between 2004 and 2008, the disease outbreaks in poultry steadily declined, since 2009 there has been an apparent increase in outbreak numbers, although in the last 2011/12 HPAI season there was a significant decline in poultry outbreaks. However, the disease is also known to be under-reported and surveillance efforts are declining in most countries given the chronic shortage of financial and human resources. Overall, there has been a progressive decline in funding for HPAI since 2010 and clear evidence of diminishing political commitment among the affected and at-risk countries. The international donor community has also decreased funding and investments in these endemically affected countries due to the global financial crisis and/or due to the cessation of the perceived threat of a human pandemic. This trend is cause for concern as the H5N1 virus continues to circulate in the endemic areas, continually evolving in an environment that presents a significant risk of the emergence of new variants with unexpected outcomes. To date, it is estimated that the disease has resulted in the loss of over 400 million domestic poultry and economic losses of over US$20 billion. While all endemic countries have experienced negative impact on poultry production and food security, of special concern are China, Egypt, Indonesia and Viet Nam. China has reported very few outbreaks over the years despite showing sporadic evidence of virus circulation from LBMs. For both Viet Nam and China, the potential impact of increased circulation of virus clade 2.3.2 in the face of the reduced use of vaccination in Viet Nam or reduced efficacy of vaccines in China may increase the number of poultry outbreaks and human events in these countries. The outbreaks may also spread to other countries in the area. To date, human to human transmission of H5N1 is a rare event. However, should it be documented, and the virus behave like pH1N7/2009, within four months all countries of the world would be affected and with a high case fatality rate.

Changes in the virus

The H5N1 virus, too, has evolved in Asia. Between 2003 and 2007, the H5N1 clades 1 and 2 were the most common. The latter clade has progressively replaced clade 1 and by 2005 had become the dominant strain globally. Clade 2 has rapidly evolved and generated a number of subclades in different epidemiological situations in various parts of Asia. Of the H5N1 clade 2 viruses, clade 2.2 has been the most common strain found in the Indo-Gangetic Plain area (Bangladesh, Nepal and India). In Indonesia, only the subclade 2.1 has been found. In Southeast Asia, the viral clade situation has been more complex and heterogeneous, while in China and northern Viet Nam the subclade 2.3.4 had been predominant until 2010. In southern Viet Nam, only clade 1 has been seen and still continues to be the most important strain of virus present. Cambodia, shares the same epidemiological environment and clade as southern Viet Nam. The Lao People's Democratic Republic and Myanmar have had multiple incursions of H5N1 viruses with outbreaks caused by clades 1, 2.3.4 and 2.3.2; and 7, 2.2 and 2.3.4, respectively. Thailand, which is now free of HPAI, has had two incursions, one with clade 1 and the other with 2.3.4.

Since late 2010 and 2011, there has been evidence that clade 2.3.2.1 is emerging as the most dominant strain in Asia. By early 2011, several countries in Asia had experienced outbreaks of HPAI due to this clade, which appears to have evolved in domestic poultry in China and altered characteristics with high virulence in wild birds. This virus has been known to spread widely in Asia by infected wild birds, including the Republic of Korea, Japan, Myanmar, Bangladesh, India and Nepal. The virus clade 2.3.2 in its various forms exists in China and may continue to expand its geographic range from Southeast Asia to other regions.

The information generated from isolation and genetic and antigenic characterization of a large number of viruses in Asia and other parts of the world, coupled with the information on disease outbreaks has improved the understanding of the virus's evolution and its implications with regard to its spread, infectivity and suitability for use in development of vaccines. The current trends in evolution present a number of concerns. These include the emergence of second, third and fourth order clades, demonstrating rapid evolution and rapid replacement of virus strains in some endemic regions, and the emergence of antigenic diversity including changes in receptor-binding capacity and the ability to break through existing vaccine strains.

Factors inhibiting progress

A number of elements that inhibit progress towards disease control, prevention, detection and elimination are common to endemically infected countries/regions. The major identified challenges in endemic countries fall into three groups: (1) the structure of the poultry sector (i.e. production and marketing or trading methods); (2) weaknesses in veterinary services and animal production services; and (3) insufficient commitment from the public and private sectors to elimination of the virus. Despite knowledge gained since 2001, the drivers responsible for changes in HPAI disease dynamics in the endemic countries are poorly understood. Additionally, challenges for control of the disease, insufficient sustained coordinated efforts and lack of case reporting are seen when a country has civil unrest and/or a frequent change of authorities.

Free-ranging domestic ducks have been implicated as the reservoir of H5N1 avian influenza (AI) in South and Southeast Asia where domestic ducks forage alongside migratory waterfowl on post-harvested rice fields – the reservoirs for LPAI. Other significant risk factors for HPAI include high human, chicken and duck densities as disease is virtually impossible to control due to the presence of millions of domestic ducks in rural landscapes, often asymptomatic and less responsive to currently available vaccines. This complexity of issues highlights the need for a multifaceted approach to address H5N1 HPAI in the agro-ecological framework where risk for virus evolution into potential pandemic strains is taking place in farming systems. While solutions exist to minimize the problems and work towards progressive control of this disease, a change in human behaviour is required. This need highlights the importance of including social, economic and anthropological dimensions in the understanding and, ultimately, in the solutions to this devastating disease.

Measures have been introduced in these countries to address the major identified challenges, but all require further long-term commitments and investment if the virus is to be eliminated. To move forward, each of the endemically infected countries should implement activities that take them closer to virus elimination and reduce the prevalence of disease in poultry and humans, progressively building upon the gains made since they first reported cases of the disease. It may also be necessary to explore unconventional methods in these hotspot areas especially since it is now generally accepted that the H5N1 HPAI virus is unlikely to be eliminated from poultry in these countries and regions for at least a decade. The extended timeframe provides opportunities to consider new and innovative measures for the control and prevention of H5N1 HPAI and influenza A (H5N1). These include better vaccines that can be delivered easily in the various poultry production sectors and do not require multiple injections of individual birds, along with methods of developing virus resistance in poultry through genetic manipulation and selection, among others (see also vaccine discussion in Chapter 4). These potential alternatives and other novel solutions for control should be considered because there is no guarantee that the current incremental approach will eliminate H5N1 HPAI, especially if the three main limiting factors are not or cannot be fully addressed. It is important to note that the actions taken will assist in preventing and controlling other diseases in addition to containing and eliminating HPAI.

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CAPACITY TO PREPARE, PREVENT, DETECT AND RESPOND – VACCINATION, BIOSECURITY AND LABORATORY CAPACITY

The objective of all HPAI activities conducted by national governments has been to gain better control over the disease or the risk of disease in order to protect public health and the economic interests of commercial poultry producers from H5N1. While the combined outcome of all the elements of the control programmes has been to limit the impact of disease, there are specific elements that deal with prevention of, response to or recovery from disease outbreaks. In the realm of disease prevention and control, in particular, there are two distinct technical aspects, namely vaccination and biosecurity.

Vaccination in endemic countries

Most endemic countries have shown a steady decline in the number of cases due, for the most part, to the HPAI control measures that have been applied. On balance, the vaccination programmes have contributed to a reduction in the environmental load of virus for poultry and exposure to humans.

Given the scale and structure of poultry production and markets, and despite limited veterinary infrastructure in developing countries, China, Egypt, Indonesia and Viet Nam undertook vaccination programmes while other endemic countries such as Bangladesh and India have not. Across China, Indonesia and Viet Nam one issue that has arisen is the role of vaccinated older "spent" layer hens in the maintenance and spread of viruses. It is clear that inadequate flock immunity enables and allows the development of subclinical and/or mild infections, and therefore propagation of virus in such birds – referred to by some national partners as duck equivalents. Cross-border or local trade in these birds has been recently implicated as a source of outbreaks. These birds may either enter market chains infected or contract infection along the way due to suboptimal immunity. Therefore, compliance and proper adherence to vaccination protocols and schedules is important for long-lived layer birds.

Endemic country vaccination considerations for the future

Vaccination considerations for the future revolve around country vaccination policies as part of a comprehensive disease control and eradication plan, vaccine technology advances that can lessen logistical and resource challenges while improving vaccine efficacy in the field and improved vaccine matching.

Vaccination policies should be tailored to each country's context and consider the strategic approach to, and exit from, vaccination as part of a comprehensive control programme that includes farm biosecurity and the application of surveillance based on sound principles and rigorous epidemiological analysis, among others. Local and national policy decisions are complex and must take into account a variety of technical and non-technical factors in order to be successful. Understanding the production sector structure and market chain dynamics, as well as the human, logistical and financial resources available for vaccine purchase quality control and delivery, virus monitoring and post-vaccination surveillance are crucial to drafting such policies. Additionally, these policies should be responsive to changes/advancements in the poultry sector, changes in the circulating virus and developments in vaccine technology. Each country's situation requires a customized approach to address the complexities of their unique circumstances. To help guide this process, FAO has been developing a decision support tree for AI vaccination. It should be recognized that in endemic areas, it may take many years of a coordinated public and private sector effort before virus circulation is reduced to the point where disease elimination may be considered. Mechanisms for ongoing engagement of the private sector through public-private partnerships should be enhanced in the future.

Ongoing research is needed to improve ease and timing of vaccine application, and to identify efficacious vaccines for ducks. For both chickens and ducks, current vaccines cannot be efficaciously administered until fifteen days of age, and require a booster. This fact presents a very large logistical challenge and requires significant human and financial resources, the burden of which falls mostly on the governments. Additionally, the timing of application is not appropriate for free-range duck production. Therefore, the ability to vaccinate day-old chicks and ducklings with the application concentrated at a single production point (e.g. the hatchery) could also have a significant positive impact on virus circulation in addition to decreasing logistical, human and financial challenges. Some AI-vectored vaccines are showing promise; however, care must be taken to understand the limitations and/or caveats to the specific vector used. One new AI-vectored vaccine uses a herpes virus of turkeys (HVT) and has demonstrated efficacy in both the laboratory and in field trials against several H5N1 clades and in the face of maternal antibodies; but further field data is needed to confirm its effectiveness in the field and whether a single dose can protect during the whole life of the bird.

In some countries, free-ranging ducks have been identified as risk factors in the ongoing circulation of AI viruses. Therefore, vaccine advances for ducks are also crucial for controlling AI circulation. Existing 'conventional' vaccines fail to demonstrate efficacy in ducks with regards to reduction in virus shedding, and, in some cases, fail to protect from disease as well. The recent development of a duck virus enteritis AI vectored vaccine in China shows promise for ducks and has the benefit of protecting against both diseases. Additionally, use of the HVT vectored vaccine in day-old ducklings is being evaluated.

The challenges that face smallholder producers in controlling HPAI are likely to continue. Vaccinating village poultry is especially highly resource intensive and difficult to manage, resulting in poor impact to overall disease control in these countries as it is not feasible to rely solely on the principles of biosecurity to eliminate the virus. Primarily because of ease of logistics, mass vaccinations so far have been carried out on a seasonal basis without taking into consideration age, production cycles and risk assessments of disease persistence or occurrence. However, development of vaccines with easier administration modes, earlier application, reduced vaccine bottle-sizes and longer-lived immunity might improve vaccination scope. Also, vaccines administered on a more age-based schedule as part of regular flock health programmes, might reduce losses and virus loads.

Efficacious vaccines should protect birds from clinical disease and mortality, as well as sufficiently reduce virus shedding to interrupt transmission across flocks. AI viruses constantly mutate and successful vaccination schemes will need to match vaccines with the latest understanding of circulating viruses and virus evolution.[39] While there is sufficient scientific evidence to show that vaccination does place selective pressure on field viruses to mutate, especially in the case of partial immunity, field data suggests that robust application of well-matched high quality vaccines (e.g. at least two appropriately timed doses for a conventional vaccine) significantly reduces virus shedding in vaccinated animals thus reducing the opportunity for mutation. Vaccines that can be easily adapted as the virus changes will be needed for the future.

There is no question that the ongoing circulation of H5N1 increases the chance of human infections and contributes to the risk of the emergence of a strain capable to transmit from human to human and cause a pandemic. These concerns go beyond monitoring influenza viruses of poultry, as reassortment of influenza viruses from different animal species has previously contributed to pandemic viruses, such as the recent H1N1 epidemic in 2009.[40] Ongoing support for global monitoring of influenza and other viruses at the human-animal-environmental interface is crucial as the HPAI H5N1 virus will be part of the global infectious agent landscape for some years to come.

For endemic countries, vaccination and virus monitoring remain valuable tools to keep virus levels in poultry in check while other control strategies are developed and applied. This approach will continue to inform disease control strategies and policy-makers at country level and will influence whatever modifications are required.

Biosecurity in endemic countries

Much effort has been put into many levels to improve the management of poultry production from free-range operations to the commercial sector. In general, it is difficult to make an assessment of the improvement in biosecurity across the entire poultry sector in endemic areas because of the multiple facets of the production environments. A main contributor to a lack of biosecurity to prevent HPAI and other diseases is limited knowledge regarding a disease threat, mechanisms for disease transmission and risk profiles. There needs to be more understanding about how biosecurity measures can be applied within the daily management of a poultry facility/animal holding and why applying biosecurity measures are worthwhile to the producer, including in economic terms. Because of this knowledge gap, successful biosecurity education and implementation is more difficult in a backyard

[39] See OFFLU avian influenza vaccine guidance (available at http://www.offlu.net/index.php?id=104).

[40] For example, see information on H7N3 in Mexico June 2012 (available at http://www.rlc.fao.org/es/prensa/noticias/confirman-brote-de-influenza-aviar-de-alta-patogenicidad-tipo-h7n3-en-jalisco-mexico/).

or free-range setting. It requires a thorough knowledge of the production systems, active stakeholder involvement, a flexible approach that fits within each smallholder's system and awareness and training programmes targeted to each sector. Increasing smallholders' understanding about how biosecurity helps other aspects of their poultry's health and operation's economic success has been a useful approach for improving practice in endemic countries.

A substantial amount of work has been done in several countries (e.g. the Lao People's Democratic Republic, China and Bangladesh) to improve biosecurity standards in LBMs. These markets offer unique challenges for biosecurity and disease transmission. Intensive follow-up is needed along with continued awareness, training and cooperation between market operators and local authorities.

In some places, proactively providing information and training about biosecurity and better practices is also a good entry point to make contacts with the commercial sector and to improve the linkages to government services in the context of public-private partnerships. Effort has been put into developing biosecurity guidelines and, in some countries, there have been suggestions about compensation being linked to proper application of the guidelines in the commercial sector. In general, considering the complexity of, and variation within, the commercial poultry sector industry throughout endemic areas, solutions developed locally through direct engagement with stakeholders have been more effective than transferring solutions from other regions. Building commercial poultry health competency within local government veterinary services is necessary for continued improved communication and trust between local government and commercial poultry farmers.

Biosecurity considerations for the future

In some environments there has been uptake of the principles when individuals and groups perceive a benefit from improving biosecurity standards. However, all these aspects require ongoing effort and some investment and there is still a lag in the implementation, especially at the grassroots level. Until the volume of poultry produced in the smallholder sector, and especially the volume for free range ducks, is reduced from current levels (greater than 70 percent of poultry are raised in systems where it is difficult to implement even simple biosecurity measures), the overall population will remain relatively exposed to risk of disease incursion.

A variety of public-private partnership mechanisms are needed to improve buy-in and commitment from both government and stakeholders in the commercial poultry industry. Continued technical and training capacity of both government and private sector stakeholders in biosecurity practices will provide a sustainable resource for ongoing training and mentorship.

By continuing biosecurity training programmes in HPAI-infected countries, each person along the chain can understand and take ownership of their part in biosecurity and the prevention of disease can be assisted. This training is required for better awareness and understanding of producers and other partners, and to ensure broader implementation of biosecurity programmes as a tool for prevention and control of HPAI and other important poultry diseases, such as *salmonellosis* and *campylobacter* infections. For example, many individuals involved in the poultry sector, including veterinary staff, do not appreciate the need for proper cleaning before disinfection. In many cases, too, manual equipment purchased for disinfection is not likely to deliver disinfectants at the rates required to affect a proper result, resulting in an often cosmetic rather than functional activity. While individuals might begin to understand some underlying principles of hygiene and biosecurity, much more remains to be done. It takes time and effort to have people change perceptions, behaviour and practices that have been ingrained.

Even though the sustainability of the training programme is largely in the hands of the private sector itself, the support of government veterinary services will be required, particularly in relation to smaller producers.

FAO should continue to support the poultry industry and the veterinary services in the development and delivery of tailored training programmes for stakeholder groups with specific needs in the poultry sector. FAO and counterpart government veterinary services should continue focusing on the identification of the most cost-effective approaches for reducing risk of disease spread at market chain critical control points and on farms. With a stronger evidence-base, specific high-impact practices can be targeted for future capacity-building and advocacy programmes. Study of risks from marketing links between sources is critical to evaluate. In particular, FAO is keen to identify farm biosecurity practices, which will reduce risk from HPAI while also improving farm profitability.

SURVEILLANCE

Timely and accurate information about disease occurrences has remained a major priority of the global, regional and national communities for implementing effective HPAI control programmes in domestic poultry. Achieving this implementation requires the capacity to detect disease events and to manage, report and analyse the outbreak information. Isolation and characterization of H5N1 viruses from disease outbreaks to monitor genetic changes and enable adjustments to vaccines that are compatible with circulating viruses is vital to enable further progress in the fight against avian influenza. Post-vaccination monitoring of antibody responses to vaccines as a measure of vaccination coverage and the targeted searching for viruses that might be present in vaccinated populations are also important activities.

Today, there is significant integration of the surveillance outputs from country programmes into global reporting systems. The reporting outputs from GLEWS/EMPRES have been greatly enhanced by the improved quality of information coming in from the country surveillance programmes.

Surveillance efforts in endemic countries

It is not realistic to expect a surveillance structure to detect every single instance of H5N1 infection. However, it is expected that when disease occurs in a recognizable outbreak form it will be reported to the responsible authorities and disease control measures will be implemented. Where the disease is endemic, the combination of surveillance and control measures are expected to keep incidence to an acceptably low level, which in the case of H5N1 is related to the concurrent incidence of human cases and the production impact on the poultry sector. Where the disease is sporadic, the surveillance system is expected to detect an incident or incursion quickly enough to pre-empt a large focus of secondary cases and to help eliminate the disease locally (see Box 3.1).

Surveillance efforts in countries were dictated to some extent by the level of H5N1's endemicity and the capacity of the animal health services. Cambodia and the Lao People's Democratic Republic do not have veterinary schools and so suffer a general shortage of qualified

BOX 3.1

Diagnostic capability in Egypt

The National Laboratory for quality control on poultry production (NLQP), accredited according to ISO17025, is responsible for the diagnosis of poultry diseases including HPAI in Egypt. During the past years, FAO projects have strengthened institutional capacity (manpower, facilities) for molecular and serological diagnosis as well as virus isolation and sequencing. NLQP has six satellite (regional) laboratories located in various parts of the country and partners with International/OIE Reference Laboratories, (twinning programmes with Friedrick-Loeffler-Institut [FLI], Germany) Apart from the routine diagnosis of HPAI, NLQP participates in epidemiological surveillance activities involving different poultry production sectors; conducts research on antigenic and genetic diversity of A/H5N1 viruses in different poultry production sectors; charts geographical distribution and immunogenicity of commercial vaccines; maintains a database on HPAI and other poultry diseases; and shares laboratory information with stakeholders.

Past NLQP achievements include:

- real-time polymerase chain reaction (RT-PCR) used for rapid diagnosis of A/H5N1 and instant result reporting;
- skilled manpower for HPAI diagnosis made available both centrally and at regional levels;
- six regional (satellite) laboratories established and accredited according to international ISO 17025;
- standardized and internationally accepted laboratory procedures and protocols adopted;
- successful results in a series of international proficiency tests;
- laboratory information management system (LIMS) and regional labs established and made operational at NLQP; and
- laboratory data and genetic material shared on time with all relevant national and international partners, and published in GENE BANK.

A four-way linking between animal and public health sectors has been initiated and is progressing well. Currently, NLQP is exerting efforts to establish a BSL3 lab and animal facility in its premises in Cairo.

The laboratory capability built over the past years and the presence of rapid response field sampling teams (involving staff from NLQP and satellite laboratories) could be put into good use in the implementation of the revised Animal Health and Livelihood Sustainability Strategy for the implementation of progressive risk reduction measures. The challenges faced by NLQP include difficulty in processing material transfer agreements (MTAs) required for the shipment of samples abroad (e.g. migratory bird studies), acquisition of reagents and equipment on time, and sustainably. The NLQP need to address these essential key steps:

- to sustain the quality of laboratory performance;
- to continue to carry out genetic characterization of circulating A/H5N1 and other viruses;
- to secure adequate stocked lab consumables/reagents to support field surveillance and outbreak investigation activities;
- to play its due role in strengthening the four-way linking between and within animal public health sectors; and
- to participate actively in all HPAI control initiatives.

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personnel and little or no prospect for continuing education. In other countries, the curricula have not evolved to provide appropriate epidemiology training. Building capacity within such a diverse range of settings has required surveillance structures that can be tailored to fit-for-purpose. The various surveillance methods currently utilized in endemic countries include: grassroots models, passive and active surveillance models, participatory surveillance models, targeted surveillance studies and risk-based surveillance. There are advantages and disadvantages to each. No one method is adequate for all situations and high-impact diseases often require a combination of methods, tailored to local or national requirements.

For example, in Indonesia, where the disease was entrenched, the PDSR system was introduced. In other countries, with small numbers of trained veterinarians and no veterinary education, the emphasis was on strengthening the existing grassroots animal health extension services supported by community-based animal health workers (CAHWs), village veterinary workers (VVWs) or village animal health workers (VAHWs) to increase surveillance networks. CAHO teams conduct successful surveillance in Egypt. There are 108 trained veterinarians in the CAHO programme, which is fully integrated into the General Organization for Veterinary Services (GOVS). Since February 2011, there has been a decrease in most of the surveillance activities done by the Ministry of Agriculture and Land Reclamation (MoALR) due to civil unrest, with the notable exception of CAHO, which continues to function relatively well. In Viet Nam considerable resources were expended to monitor the mass vaccination programme. While post-vaccination monitoring is more closely aligned to disease control there was also an element of that programme that focused on virus monitoring of target markets in an area after vaccination. Other fit-for-purpose examples include countries like Bangladesh, which utilizes mobile telephone technology and short message service (SMS) gateways for sharing disease information in a surveillance network. And Cambodia and the Lao People's Democratic Republic have introduced hotlines to give the public ready access to the reporting channel for animal health. It is worth noting that the use of field diagnostic detection kits by surveillance teams has been a somewhat vexing question for animal health services. While the practice has proven successful in Indonesia's PDSR programme, in other jurisdictions central administrations have preferred to leave diagnostic decisions to the central laboratory; a reasonable position where disease occurs sporadically and accurate diagnosis is important.

BOX 3.2

Defining the role of wild birds in the H5N1 HPAI story in Central Asia

Early in the HPAI emergency, it was postulated that wild birds could be the HPAI H5N1 reservoir and that they played an important role in the dissemination of HPAI H5N1 to new environments, especially the rather spectacular spread of the virus to Europe and Africa in late 2005. Competing theories for the long- range movement of the virus and incursion into Europe and Africa included both legal and illegal poultry or wildlife marketing and trade. HPAI H5N1 viruses had been isolated from captive wild birds in China, Hong Kong SAR as early as 2003, so there was a precedent for the potential for this virus to infect wild birds. There were also a number of situations where contact between poultry and migratory water birds was possible, but their exact role as potential reservoirs or disease-transmission vectors was undetermined. Since 2005, HPAI H5N1 wild bird mortalities have been reported from thirty-eight countries in Asia, Europe, Africa and the Middle East. FAO and other collaborators have made significant efforts at the global scale, to determine the true role of wild birds in the HPAI H5N1 story.

To evaluate the situation, FAO implemented a wild bird disease ecology programme that included surveillance and radio-marking of wild birds to determine whether they tested positive for the virus. They were also able to delineate whether wild bird habitat use and migration patterns correlated spatially and/or temporally, with the patterns of AI outbreaks occurring at a global scale in both wild birds and poultry.

Wild birds as the HPAI H5N1 reservoir

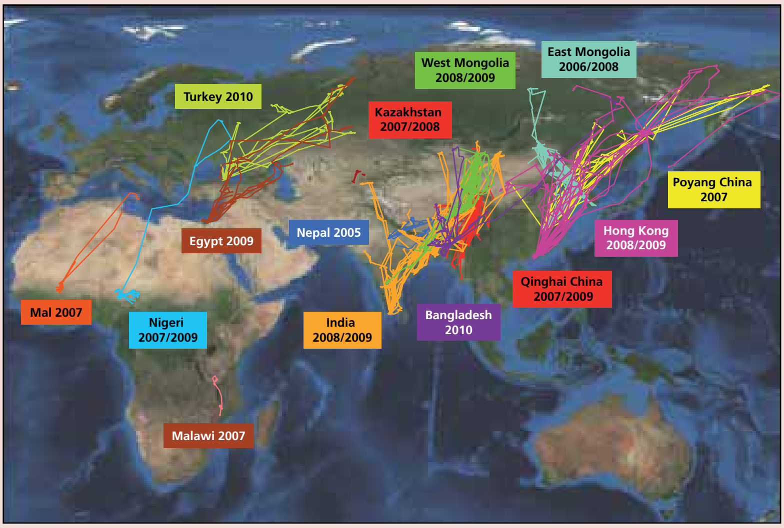
Over the past six to seven years, FAO and other organizations have collected approximately 750 000 samples from healthy, free-ranging wild birds including waterfowl, waders, shorebirds and passerines. The surveillance results demonstrate that wild birds are not the reservoir for HPAI H5N1.

Wild birds as the HPAI H5N1 transmission vectors

To determine the role of wild birds in spreading HPAI H5N1 geospatially, initial efforts analysed for correlations between FAO generated GPS waterfowl migration data (timing of migration and spatial attributes of migration), the timing and location of HPAI outbreaks (from FAO EMPRES i) and poultry densities (from FAO's Gridded Livestock of the World [GLW]). Further refinement of analyses incorporated other agro-ecological variables that predicted HPAI events including rice cropping intensity, domestic duck and chicken densities (FAO maintained data) and human population densities. When the FAO waterfowl migration data was overlaid, it appeared that certain wild birds movements were correlated with locations predicted to have outbreaks. Eventually outbreaks did occur at exactly the time when migratory waterfowl were on their northern hemispheric spring migration.[1] The most recent advance applied to the analyses of the role of wild birds. It makes use of an eco-virological approach whereby GPS migration patterns are analysed in relation to 1) the spatio-temporal patterns of poultry and wild bird outbreaks of HPAI H5N1 and 2) the trajectory of the virus in the outbreak

(cont.)

region based on phylogeographic mapping. This technique advances the science of understanding the role of wild birds in the HPAI story as it takes into account publically available genetic information about the HPAI H5N1 clades, maps out the trajectory and distribution of specific virus clades and enables analyses to incorporate virological data as well as other agro-ecological risk factors and migration pathways.[2]



[1] Gilbert, M., Newman, S. H., Takekawa, J. Y., Loth, L., Biradar, C., Prosser, D. J., Balachandran, S., Subba Rao, M. V.,Mundkur, T., Yan, B., Xing, Z., Hou, Y., Batbayar, N., Natsagdorj, T., Hogerwerf, L., Slingenbergh, J. & Xiao, X. (2010) Flying over and infected landscape: distribution of highly pathogenic avian influenza H5N1 risk in South Asia and satellite tracking of wild waterfowl. *EcoHealth* 7(4): 448-458 (also available at http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3166606/).

[2] Newman, S. H., Hill, N. J., Spragens, K. A., Janies, D., Voronkin, I. O., Prosser, D. J., Yan, B, Lei, F., Batbayar, N., Natsagdorj, T., Bishop, C. M., Butler, P. J., Wilkelski, M., Balachandran, S., Mundkur, T., Douglas, D. C. & Takekawa, J. Y. (2012) Eco-virological approach for assessing the role of wild birds in the spread of avian influenza H5N1 along the Central Asian flyway. *PLoS ONE* 7(2): e30636 (available at http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone).

Notably, no country has felt a need to establish a formal mechanism for joint public health-animal health surveillance, although in some places community level programmes were initiated using community health workers (i.e. public health) to report on animal health status of the community's poultry. In some instances joint outbreak investigations, a form of surveillance, have been conducted. For example, there has been at least one joint investigation in Egypt after a human HPAI case and a joint ERV investigation in 2009 in the Philippines. Ongoing efforts continue, when appropriate, for joint surveillance investigations.

Overall, endemic countries have grown in their capacity, ownership and leadership in surveillance as a result of developing locally relevant models and approaches based on needs. Decision-makers are beginning to appreciate the usefulness of a strong surveillance structure not only for avian influenza, but also for other animal diseases. In fact, a significant outcome of efforts has been that national animal health staffs now have transferable skills in surveillance and can respond to the increasing challenge of other emerging and re-emerging diseases such as the initial phase of the H1N1 2009 pandemic, PRRS, FMD, anthrax and brucellosis.

Surveillance considerations for the future

The effort to build epidemiological expertise in endemic regions must be continued, with emphasis on practical aspects such as the design of surveillance activities, data management, simple analysis, maintenance of regional and international networks and high-quality outbreak investigations, with intersectoral collaboration where possible. Each country has questions about disease epidemiology that can be answered by studies, and these should be supported with resources.

The FAO-OIE-WHO four-way linking project, which connects at least four information streams – epidemiological and virological, each from animal and human health – is critical when assessing the public health risk of influenza at the human-animal interface. The project supports countries to increase understanding of national risks from H5N1 influenza viruses by building a framework for strengthening systems to collect and link national data and facilitating national-level risk assessments and risk communication. The project is being piloted in H5N1-endemic countries such as Egypt, Viet Nam, Bangladesh and Indonesia. A complementary linkage, which also needs to be strengthened, is between field and laboratory data across both the animal health and public health sectors (see Four-way linking Box 4.4 in Chapter 4).

There is an emerging view that the number of viruses that are sequenced, as well as their geographic representation, needs to be greatly increased, and that the time between virus isolation and sequence information needs to be significantly reduced. It is suggested that surveillance could be improved, for example, by creating a network of sentinel sites, focusing on the countries and regions most at risk, which would collect isolates and sequence them in real time.

Monitoring and characterizing field virus isolates for changes in behaviour may assist in signaling vaccine failure and possible spread and new outbreaks of disease. The H5N1 sub-clade 2.3.2.1 is a case in point: a genetic variant of the clade 2.3.2.1 was able to break through the vaccine used in Viet Nam, and the increased susceptibility of the sub-clade 2.3.2.1 to wild birds has resulted in the spread of the virus in Japan, the Republic of Korea, Bangladesh, India and Nepal. The importance of regular isolation and characterization of viruses from field outbreaks has been recognized in Indonesia, as well. Poor vaccine efficacy in Indonesia was recently rectified by incorporating the appropriate virus strain compatible with the circulating viruses in the field.

Recent experience with H1N1 influenza has highlighted the need for increased monitoring of influenza viruses circulating in the large concentrations of pigs in several countries. This monitoring seems especially important in Asia where H5N1 circulates in poultry populations, and large duck populations mingle with wild birds, presenting pathways for new viruses to enter pigs via poultry. Longitudinal virological surveillance not only in poultry but other livestock is now considered a must for assessing the evolution of the virus and the risk for pandemic influenza. FAO is starting to do surveillance through the EPT Plus Program (see Chapter 4).

The work to date has demonstrated that, wherever possible, training should include ministries of agriculture, forestry/environment and public health to develop trust among partners and to cross-pollinate areas of expertise. Planning for surveillance and outbreak response should also include ministries of agriculture, forestry/environment and public health. For large projects such as those on disease and migration ecology, planning, coordination and implementation must involve at least the ministries of agriculture and forestry/environment.

The experiences of coordination between animal health and human health authorities in dealing with HPAI have laid the foundation for expansion into other zoonotic diseases and for collaboration on possible emerging infectious diseases. Increasing understanding and acceptance of the One Health approach in animal health services in endemic regions has also improved the prospects for developing it further (see Box 3.2).

STAKEHOLDERS MATTER – SOCIO-ECONOMICS AND COMMUNICATION

Socio-economics – where we are

Socio-economic activities in 2011 centred on gaining further insight on the rationale behind decisions from household to governments – in essence, understanding the why and the how. This knowledge provides the basis for understanding the drivers of disease from the human aspect. Production systems, food chains and the humans involved are diverse, complex and dynamic, and all affect disease prevention, control and elimination. Beginning at the local level, FAO efforts focus on understanding the needs of livestock holders/keepers. What are their concerns? What motivates their behaviour? And what are their limitations and why? As well, 2011 activities focused on understanding how the entire marketing and trade chains are structured, interact and affect disease dynamics and control.

By the end of 2011, socio-economic analysis of a range of issues related to disease control was well advanced in endemic countries and the usefulness of the outputs is now appreciated by animal health services. Poultry production systems and the main actors in value chains have been identified and characterized for the purpose of better understanding their disease control compliance incentives and efficiently targeting interventions. In many countries, poultry sector reviews have been made available to disease control planners and sector development policy-makers. HPAI control costs for vaccination, surveillance and culling have been assessed and can be used to budget the required financial resources for technically efficient disease control measures. Vaccination costs and willingness-to-pay assessments in Viet Nam showed that there is limited scope for public sector savings with

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more targeted or voluntary AI vaccination while maintaining an acceptable HPAI risk level. FAO and governments now have a clearer picture of the complexity of the poultry production sector and its concerns. In China, value chain and network analyses identified LBMs as a high risk for the onward spread of HPAI to other markets. This finding helped to target the use of the limited funds available to increase biosecurity conditions in markets by prioritizing these critical points in the chain.

Socio-economics activities and analysis insights have helped realign some of the approaches to disease to be more compatible with national and regional circumstances. The tools used have been impact assessments, compensation frameworks, value chain studies, and cost benefit studies and control costs assessments. In addition, trade flows have been mapped and there has been a focus on understanding incentives. For example, it has been shown that rather than treating the borders themselves as risk points the issue to address is the nature of the value chain that crosses the border. Because many borders are porous, interventions into cross-border trade are not easy, and a risk-based approach using the value chain has emerged as the most effective way to manage the disease risks. Investments into quarantine-type tactics at borders, still favoured by some administrations, are not cost-effective. Also, awareness and behaviour change campaigns targeted to reduce the cross-border trade risk were ineffective in the face of the high economic driver of the price differential of the traded poultry products. Engaging directly with players in the chain so that they are aware of the role that they play and are provided with tactics to manage risk has proven valuable. Overall, there is increased knowledge about the sophisticated, complex and heterogeneous food systems in which disease occurs. Surveillance strategies have been adjusted taking into account the trade flow of poultry and poultry products. The biosecurity-based classification of poultry production systems has evolved to take into account the purpose for which poultry is produced and the value chain to which the product is linked. With respect to compensation programmes, there are still gaps in the application, although models for improving compensation have been developed for Nepal and Viet Nam.

The considerable negative economic and social impacts of culling and movement control have been determined and are used to advocate for a more tailored use, or disease control measure based on epidemiological assessments rather than a fixed three kilometre ring. The estimated vast negative market impact from demand shocks has also been used to advocate for enhanced risk communication. For example, examination of willingness to pay, vaccination costs and coverage of AI vaccination scenarios delivered the evidence that cost-effective vaccination and substantial costs savings for the public veterinary service were not possible dual outcomes in Viet Nam.

An important anthropological study in Cambodia (see Box 3.3) described the attitudes of rural people to HPAI and HPAI control directives, noting that until behaviour change communication took note of and respected cultural beliefs about disease, a gap would exist between awareness and practice. This study has greatly informed communications and disease control thinking. There were also important studies on gender issues related to poultry production and disease control in Cambodia and Myanmar.

Socio-economic considerations for the future

Animal health services and other stakeholders appreciate outputs from socio-economic interventions. The knowledge base will not be lost, but it will be hard for animal health services to find resources to conduct more investigations, especially as circumstances change. The expertise to do such work does not have a natural home in an animal health service and so it must be housed is another part of the ministry – for example, a department of animal production – or sourced from outside the government. Because of this limitation, it is necessary to ensure that a certain capacity is maintained in animal health services to analyse and collect the required data, and to ensure more effective and efficient animal disease control. This capacity will also allow for clearer engagement between veterinary services and policy-makers, and thus clearer access to funding resources. Within FAO, the value of the approach is now recognized and will be a component of any programme in animal health.

The control of HPAI and other high-impact emerging and re-emerging infectious diseases can only be effective if incentives to stakeholders and the context within which they operate are taken into account. A detailed value chain, impact and control cost understanding, and assessments for other livestock sub-sectors are required as part of any disease control intervention, project or programme. This requirement applies especially to any projects or programmes that are launched using a One Health approach. The programme should assess the potential impact of market chain-based interventions to reduce the risk of other emerging infectious pathogens concentrating along urban market chains and subsequently spreading to dense urban populations. Guidelines are needed for conducting HPAI impact assessments for use by governments.

The poultry industry contributes considerably to countries' gross domestic products and, thus, is a valuable national resource that must be protected. Poultry associations need to be kept on board with government policies towards HPAI control and prevention. Backyard, village-level producers need more support and guidance on the spectrum of poultry-raising issues, including husbandry and health, so that poultry production may reach its potential to provide income and nutritional benefits to these community members. The HPAI programme needs to become more aligned to the issues facing poultry farmers from productivity and profitability perspectives as well as livelihood resilience. Poultry or general livestock sector development policies to achieve sustainable and efficient production with healthy animals must become integral to animal health promotion programmes.

BOX 3.3

Socio-economic best practices: lessons learned from endemic countries

In 2005, little was known about poultry production systems and their value chains. Socio-economic studies have been a major thrust of activities in endemic countries in order to better understand drivers of disease, human dynamics, production systems and value chains. These activities have greatly increased the understanding of these sectors in countries and of the tactics needed for the efficient utilization of resources for disease risk reduction. Lessons learned include:

- The value chain approach is fundamental in achieving an understanding of the patterns and critical control points in poultry production and marketing chains, as well as facilitating risk management.
- Participatory interaction with stakeholders in value chains leads to solutions relevant to their interests and increases their engagement in the disease control programme and ownership of the outcomes.
- Assessment of poultry sector stakeholders' incentives is being included increasingly when designing disease control measures that depend on their compliance.
- Case studies and better understanding at the household level are very useful to inform government about the impacts of disease and control programmes on the livelihoods of the less privileged.
- Providing visual and two-dimensional imaging of production systems, market chains and trade flows using geographic information systems (GIS) and maps has helped communication with decision-makers.
- Livelihood frameworks are useful for analysing the contributions poultry production makes at the stakeholder level and in designing and assessing the likely impact and acceptance of policy changes on stakeholders.
- The inclusion of anthropological analysis can provide vital information on incentives and is a useful dimension to the multidisciplinary approach needed for addressing complex issues such as HPAI control.

Applying HPAI socio-economic lessons in Cambodia

FAO socio-economic analysis in Cambodia has covered the following areas:

- socio-economic impact and smallholder livelihoods' assessments;
- surveys of consumer preferences for poultry products, especially live birds;
- poultry value chains assessments within the country and also at border areas;
- characterization of native chicken and duck production systems and the supply of ducklings; and
- biosecurity assessments of poultry markets and livelihood impacts of involved traders.

In 2007, FAO began helping the Royal Government of Cambodia to draft their animal health and production legislation. After a lengthy consultative process with all stakeholders, the final draft was produced in November 2011. This draft is now with the interministerial committee, and is expected to be approved and presented to parliament by early 2013.

Communication – where we are

FAO has made significant and influential contributions to strengthening the understanding and practice of advocacy and communication across endemic countries and regions.

In Egypt, effective animal health and behavioural change communication (BCC) efforts were integrated with promotion of farm biosecurity and proved to be successful. Closer assessment of past efforts strongly suggests that communication messages need to be tailored further and the media of communication revisited. Integrating BCC with actual animal heath interventions in the field has proven to be the most effective approach. CAHO and its outreach communication experts address the need for greater access to extension services.

In Cambodia and the Lao People's Democratic Republic, FAO has been an active participant in national level working groups that coordinate the communications effort, such as the National Coordinating Committee on Information, Education and Communications (IEC) for avian and human influenza (AHI) in Cambodia. In-country communications, operatives have been actively involved in field activities. FAO collaborates and coordinates with WHO, UNICEF and the NGO designated by USAID to carry out the communication programme, Academy for Educational Development (AED). In both countries, FAO has participated in building capacity within the government system to deliver communications and also to train key community persons at the next level. They have engaged with trusted figures in the community such as village chiefs, local veterinary workers – CAHWs in Cambodia, VVWs in the Lao People's Democratic Republic – and the Lao Women's Union.

Since the Lao People's Democratic Republic and Cambodia have very little commercial poultry sector and the disease occurs only sporadically, the effort was to reach as many communities as possible in higher risk areas to stimulate dialogue among villagers about HPAI. In Cambodia, there were specific activities with community forums, and effort was put into building the communications capacity of provincial and district officials, as well as village chiefs and CAHWs, both of whom are influential with the public. FAO's anthropological study in Cambodia, *Bridging the gap between HPAI "awareness" and practice in Cambodia*,[41] revealed that high levels of awareness about HPAI did not lead to much change in community attitudes and behaviours towards managing the disease. In the Lao People's Democratic Republic there was more participatory training involving provincial officials interacting with village chiefs, VVWs and representatives of the Lao Women's Union.

While community participatory approaches have been strongly deployed in Indonesia, there is a particular emphasis on training the official veterinary services in these approaches. Also, since government capacity to develop technical communication support materials was low, FAO helped produce these. Participatory approaches have been shown to be effective for developing IEC materials and delivering messages to a range of target audiences, and the use of these processes ensured the development of appropriate materials by stakeholder group and by gender. FAO has trained a network of 2 500 local animal health workers in basic participatory communications and has supplied them with standardized training materials.

[41] Available at http://www.fao.org/docs/eims/upload//241483/ai301e00.pdf

Communication – considerations for the future

Mass communications that require community engagement require a level of financial support that is unlikely to continue. However, strategic communications and advocacy will be a significant component of One Health approaches to problems and it is important that FAO leverages lessons learned and develops guidelines and approaches for maximizing the efficacy of communications within a multisectoral and multidisciplinary programme. ECTAD's current approach towards both communication and advocacy is tending towards regional level strategies and guidance followed up by national level initiatives.

At present, considerable animal health communications capacity is in the hands of individuals and is not institutionalized because, like socio-economics, communications expertise is not seen as fitting naturally within animal health services. Reducing external resource support for communications threatens progress made to date. To sustain the communication capacity within animal health services, it is necessary to empower these services to deal with communications professionals and to pursue the course that they see as technically appropriate to the problem at hand. This agenda may be achieved partly through One Health initiatives, but it may also be necessary to have a communications network specific to animal health professionals across regions.

FAO will continue working closely with the animal health services of national governments to ensure close alignment between the technical directions of disease control programmes and the advocacy needed to bring about policy and regulatory changes to facilitate disease control efforts.

FAO will probably not undertake mass communication programmes directly, but will need to take a strong and equal role in helping develop guidelines, strategic frameworks for communication and advocacy, tools, process, and overall guidance, both for HPAI and One Health projects. To ensure that communications plays a supporting rather than independent role in the field, FAO's technical leaders will need to be well versed in communications theory and practice. Building and strengthening this capacity will be a key role for a communications practitioner located in all FAO regions.

There is potential for FAO to engage with existing extension services to deliver communication about biosecurity, improved production management practices and general animal health, especially poultry health. Some quality control of the extension process is advisable here as, generally, there is not resident animal health expertise within national agricultural extension services.

COORDINATION AND PARTNERSHIPS FOR ENDEMIC COUNTRIES

Coordination and partnerships at the local, national, regional and global levels have been essential in the eight-year HPAI effort in all countries. Coordination and a concerted, sustained effort are vital in endemic areas. FAO has played a central role in forging and coordinating partnerships among a number of players and stakeholders involved in the control of HPAI and other high-impact emerging and re-emerging infectious diseases. These have included partnerships with national governments, NGOs, donors, national and international research institutes, regional organizations and other international developmental and technical agencies. Except for Singapore and Brunei Darussalam, FAO is represented officially in all countries in South, Southeast and East Asia, as well as in Egypt, and enjoys a formal relationship with the respective ministries of agriculture or their equivalents. This relationship enables FAO to take up projects at the national level without the need to develop additional memorandums of agreement. FAO also hosts a bi-annual regional conference (Asia Pacific Regional Conference) for the ministers of agriculture and regional organizations, where important decisions on regional priorities and policy issues are discussed and made. In addition, FAO has formal collaborative agreements with ASEAN, SAARC and other UN and international intergovernmental organizations, such as WHO, UNICEF and OIE; as well as multilateral donors such as the WB and the ADB. FAO has worked closely with these international partners to develop global and regional plans. Close coordination on animal health technical matters with the Senior United Nations System Coordinator for Avian and Human Influenza (UNSIC), and UN agencies such as WHO and UNICEF has helped to improve understanding of the issues at the source of the disease and to synchronize messages across the UN System.

FAO's coordination role has been significant in forging productive partnerships with national governments, regional organizations, national NGOs and international non-governmental organizations (iNGOs), national and international research institutes, other international developmental and technical agencies and the international donor community. FAO's formal relationship with ministries of agriculture in respective member countries has enabled rapid development, establishment and implementation of national HPAI prevention and control programmes. The technical expertise has enabled the setting up of programmes to improve capacity to detect, diagnose, report and respond to a disease emergency in a rapid and timely manner. Through technical advice and support, FAO has been able to enhance regional cooperation and promote greater transparency in sharing disease information by the establishment of regional diagnosis and surveillance networks through involvement of regional organizations. FAO has also been able to form and mobilize multi-disciplinary teams derived from various sectors to include disease managers, communicators, socio-economists, wildlife experts, epidemiologists, virologists, molecular biologists and public-private partnership experts to address a complex disease problem of global significance.

While coordinating and implementing the response to HPAI across the Asia-Pacific region, Central Asia and Egypt, FAO has managed major projects funded by a large number of donors. Many governments have established mechanisms to coordinate the public health and animal health aspects of their overall response to HPAI with FAO's close and continuous involvement with the functioning of these mechanisms either through ECTAD teams or the FAO representative. FAO has worked as a neutral broker within the government systems of its member countries, ensuring that the government's interests receive due priority from a large number of national, regional and international partners. Though this may have been a challenge in the beginning, over time FAO has become a trusted partner supporting efficient technical approaches and advocating policy issues that support HPAI prevention and control in the interests of international, regional and public good. By adhering to its core principles, FAO has become an effective coordinator and partner. FAO has also played a consistent role in the functioning of the United Nations's country level coordination mechanism.


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ENDEMIC COUNTRY SITUATION UPDATE SNAPSHOTS

Bangladesh

2011 Disease situation overview

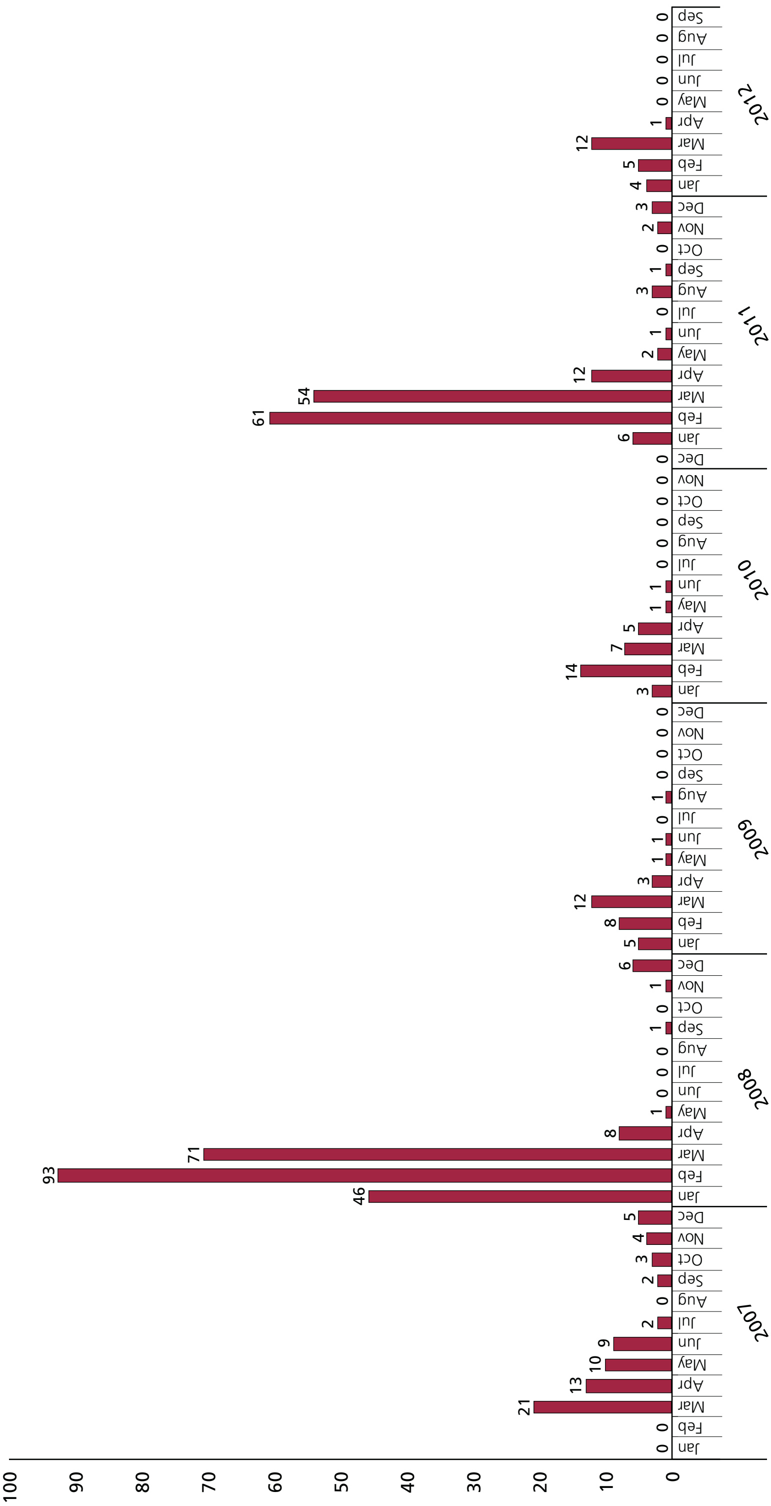
During 2011, **Bangladesh** (see Figure 3.1) experienced an increase in outbreak numbers in poultry (from 31 in 2010 to 145 in 2011), mostly in commercial poultry from five areas, three of which were infected during 2010. Areas affected in Bangladesh were Barisal, Chittagong, Dhaka, Khulna, Rajshahi and Sylhet. While most outbreaks occurred between January and April, outbreaks were also observed during 10 out of 12 months (see Figure 3.1). A new incursion of clade 2.3.2.1 was observed for the first time in Bangladesh (in crows and chickens) in January and February, and this is now the dominant strain with evidence of spillover into India. Virus clades from outbreaks between April and June 2011 belonged to clade 2.3.2.1 and 2.2.2. Clade 2.3.4 was identified in poultry in February 2011 in Feni (Feni District), and in March in Rupsa (Khulna District). The virus isolates from the 2010 outbreaks belonged to clade 2.2, sublineage III and clustered with sequences of viruses from Bangladesh isolated from 2007 to 2009. As of 31 December 2011, a total of 529 outbreaks were recorded in 52 out of 64 districts. These included 31 outbreaks in 2010, 32 in 2009, 226 in 2008 and 69 in 2007. Out of these outbreaks, 472 occurred in commercial poultry farms and 57 in backyard poultry (see Figure 3.2).

Current and future issues overview

The current policy of the government emphasizes early detection and containment by culling (compensation is included), as well as the improvement of biosecurity in various production sectors. Poultry vaccination against H5N1 AI is officially prohibited. Over 2.4 million birds have been culled and over 3.1 million eggs have been destroyed since 2007.

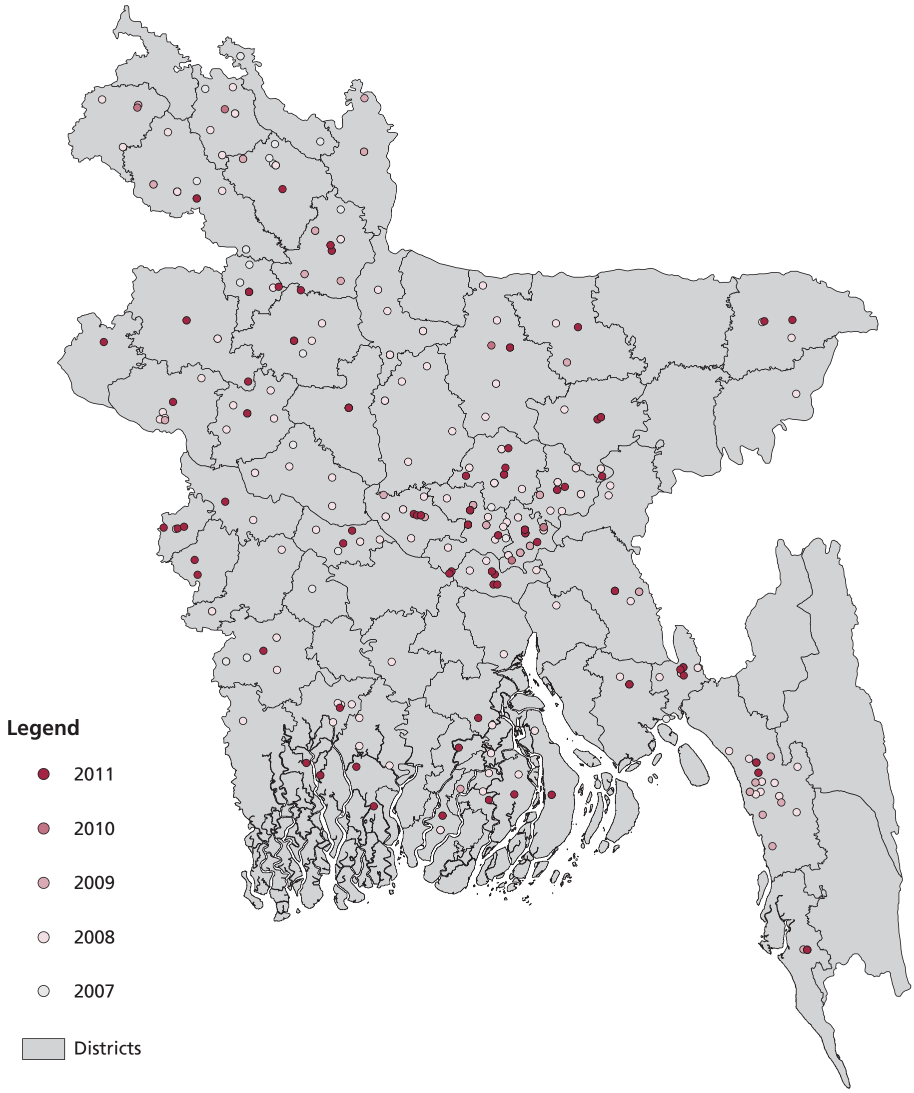
FAO is coordinating and supporting active surveillance that has been expanded to 306 upzalias (subdistricts) across the country, including the innovative use of the SMS gateway as a reporting tool. Daily, in each upzalia, avian influenza workers (AIWs; formerly designated CAHWs) employed by the active surveillance programme send SMS codes via text messages to the Department of Livestock Services, regardless of the presence or absence of disease and deaths in poultry (positive and zero reporting). SMS messages of suspected

FIGURE 3.1
Monthly incidence of H5N1 HPAI outbreaks reported in Bangladesh from March 2007 to April 2012



Source: FAO-EMPRES-i.

FIGURE 3.2
Distribution of HPAI outbreaks in poultry in Bangladesh during 2007–2011



Source: FAO-EMPRES–i.

HPAI events are automatically forwarded to the livestock officer in the area who will respond by initiating an investigation. For example, in October, November and December, 26 238, 23 571 and 25 812 SMS messages were received, respectively, including 171 suspected HPAI events in backyard poultry and 323 suspected events in commercial poultry farms. The veterinary investigations that followed excluded 494 of these suspect cases and on 47 occasions, diagnostic specimens were collected. Active surveillance using the SMS gateway in Bangladesh detected about 80 percent of outbreaks in 2011, and brought the time from detection to response from an earlier average of 4.5 days to 1.8 days. (It is important to note that a supporting factor may have been the increase in compensation paid).

LBM surveillance was also recently used and was responsible for demonstrating high levels of environmental contamination with H5N1 virus in all the LBMs in and around Dhaka.

Biosecurity programmes have progressed furthest in Bangladesh. LBM projects conducted resulted in 24 markets upgrading and the introduction of hygiene practices to improve the overall biosecurity of the markets. Constructive dialogues have been established between public and private sectors through neutral facilitation by FAO. Senior veterinary officers have been trained in biosecurity auditing of commercial poultry farms and acted as trainers for field level veterinarians. Biosecurity training was also provided throughout the country for poultry industry suppliers as well as farm managers. Continued dialogue between public and private sectors has evolved into collaborative efforts aimed at accessing international markets through compartmentalization. However, some commercial farms remain unregistered and these do not comply with standards. Therefore, it is understood that incentives will be needed to encourage registration and compliance.

China

The official reporting of outbreaks of H5N1 HPAI in China over the last six years is shown in Figure 3.3. According to WHO, in 2011 there was one human case fatality bringing the overall reported human cases in China since 2003 to 42, with 28 deaths. **China** reported one outbreak of HPAI H5N1 in poultry in Tibet Autonomous Region in December 2011 and a number of H5N1 AI related events in poultry and wild birds in China, Hong Kong SAR during the first and last quarter of 2011 and January 2012. In China, Hong Kong SAR, there were four wild bird events and four outbreaks in reported poultry during 2011. In addition to the wild bird events in December, one positive chicken carcass was identified in a LBM as part of ongoing active surveillance. This latter finding led to the immediate culling of 19 451 poultry, including 15 569 chickens, 810 pigeons, 1 950 pheasants and 1 122 silky fowls in China, Hong Kong SAR. In January 2012, there were one poultry outbreak and six wild bird events.

Though no outbreaks were reported during the first three-quarters of 2011 on mainland China, ongoing active surveillance in LBMs at national and provincial levels during March, June, July and December resulted in virus-positive samples. This finding confirmed that H5N1 viruses are still circulating in many provinces in domestic poultry along with the likelihood that disease outbreaks go undetected or not reported to or by the authorities. Virus-positive provinces identified during 2011 include Anhui, Chongqing, Guangdong, Guangxi, Hubei, Hunan, Fujian, Zhejiang, Guizhou, Sichuan, Yunnan, Zhejiang, Jiangxi and Jiangsu. All the clades of Asian-lineage H5N1 HPAI virus found globally have been detected in China. Of particular interest is the recent expansion of clade 2.3.2.1 which was originally isolated in 2004 from a dead Chinese pond heron in China, Hong Kong SAR and has now expanded its geographic range to include Mongolia, the Russian Federation, Nepal, Romania and Bulgaria. In China, Hong Kong SAR, viruses from clade 2.3.4 were also detected in wild birds and poultry in 2009. The recent positive events in wild birds and poultry carcasses are associated with clade 2.3.2.1.

The spatial distribution of outbreaks indicates that the incidence is higher in the southeastern part of the country (see Figure 3.4).

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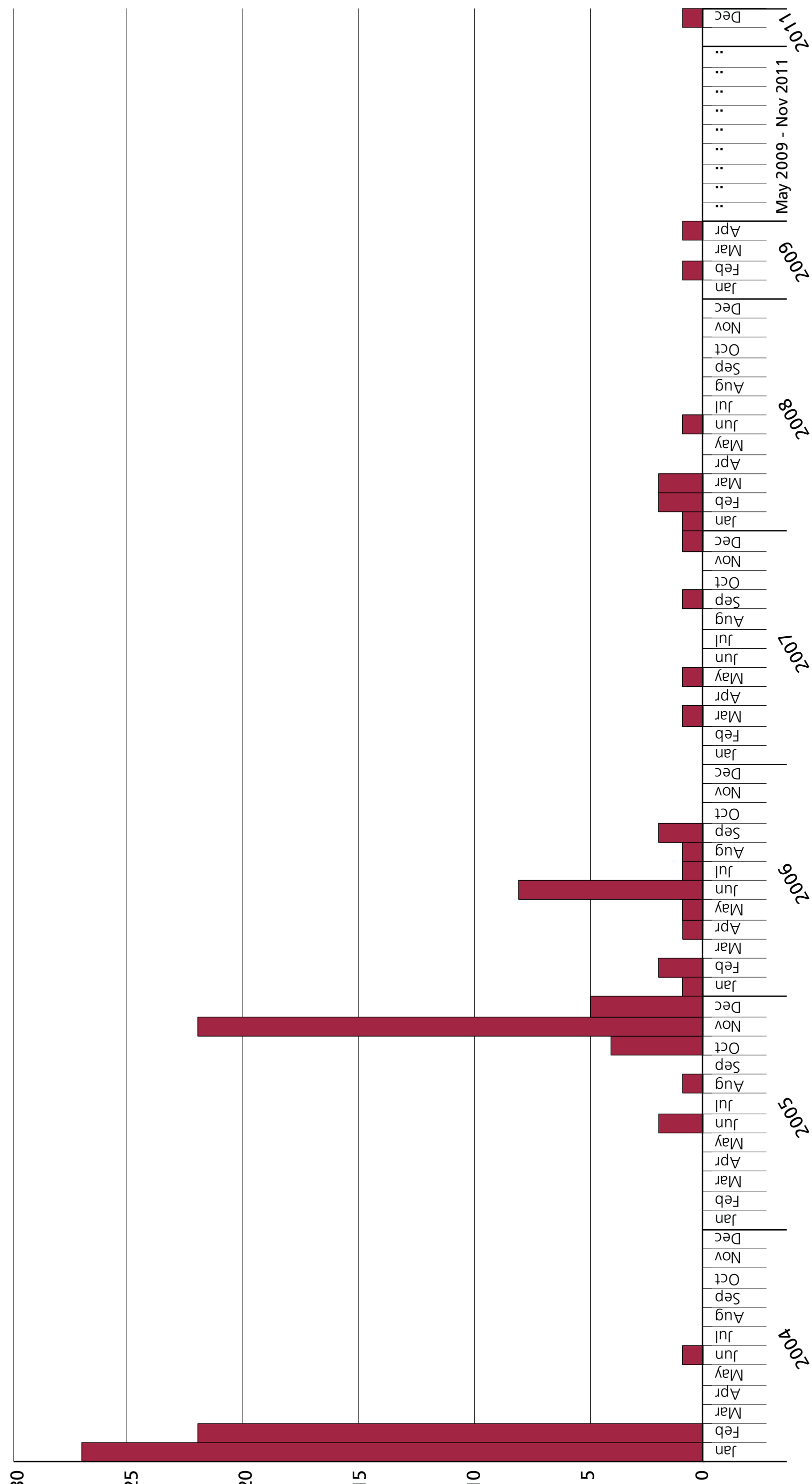
Current and future issues overview

China has been at the forefront of vaccine development for AI. FAO provides support to China by way of epidemiological training and advice with respect to assessment of vaccination, and advice on the general performance of the mass vaccination programme. China has instituted a mass vaccination programme since 2004 with more than 10 billion doses of vaccine being delivered annually. Consistent monitoring, and isolation and characterization of field virus strains have enabled national authorities and researchers to modify vaccines to match with the circulating viruses. The national authorities have also developed vaccines through reverse engineering from these field isolates, which have been successfully employed in the mass vaccination campaigns. While this campaign has the full support of the government and considerable resources have been committed, there are still constraints recognized with achieving sufficient coverage of poultry raised in rural smallholder communities and in areas where there are large domestic duck populations. In addition, there has been an historical overdependence on vaccines for animal disease control and this probably has affected the development of other traditional disease control measures and epidemiological assessments of the outcome. Two issues of concern include application of selection pressure for virus mutation through either large-scale programmes or related to inadequately immunized poultry. In the commercial sector there are many proficient operators who probably have sufficient biosecurity systems to avoid infection but who maintain vaccination because of the significant economic loss that would be suffered in the event of an outbreak in such an enterprise. China is currently looking to develop more tactical or risk-based vaccination to reduce costs and to increase the efficiency in the overall programme. FAO will continue to support these new strategies where possible.

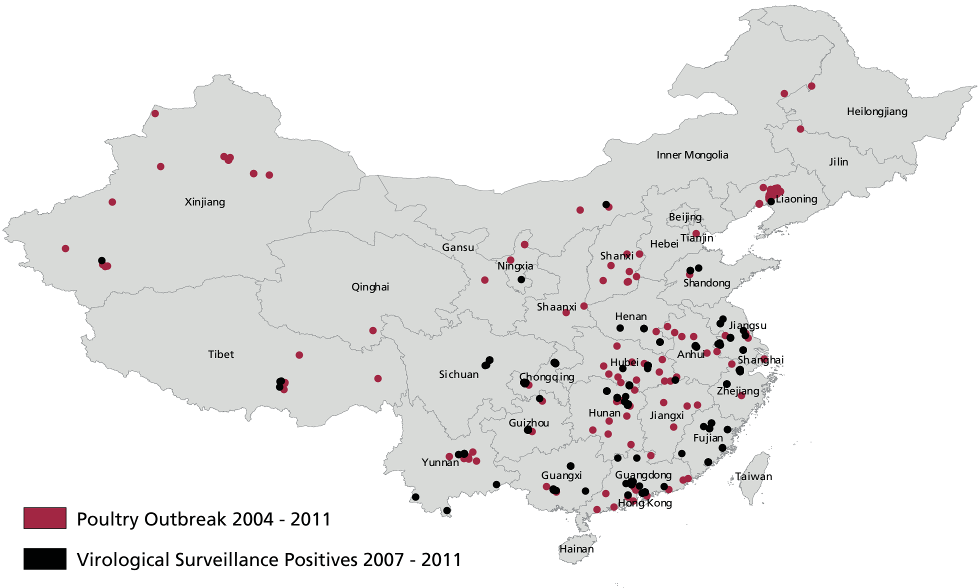
There are limited training resources and a great need for veterinary epidemiologists. Training on veterinary epidemiology at the provincial level also needs support. China's FETPV is providing tailored support to professional development. Continuing international support is needed to strengthen the programme and to better leverage Chinese counterpart's financial and technical support. Joint activities, such as outbreak investigations, data analysis and awareness campaigns, between China FETPV and China Field Epidemiology Training Program C-FETP (Public Health) are planned.

FIGURE 3.3
Monthly incidence of H5N1 HPAI outbreaks reported in mainland China from January 2004 to December 2011



Source: FAO-EMPRES–i and Ministry of Agriculture of China.

FIGURE 3.4
Distribution of HPAI H5N1 outbreaks and HPAI H5N1 positive samples identified through surveillance in China between 2004 and 2010



Note: Red squares: H5N1 HPAI outbreaks; Black squares: H5N1 HPAI positive samples identified through surveillance.
Source: FAO-EMPRES-i and Ministry of Agriculture of China.

In China where the clinical expression of the disease is becoming an exception, the Chinese national veterinary authorities face new challenges with the silent circulation and likely persistence of H5N1 HPAI, in traditional LBMs or specific ecosystems where free-ranging duck-rearing systems are dominant. To address these challenges and to design targeted risk-based surveillance and control interventions, better knowledge of H5N1 HPAI risk factors is required as well as innovative ideas for better integrating poultry production and marketing systems into risk assessment. Among these techniques, value chain analyses and social network analyses are playing an increasing role in describing infectious disease transmission patterns and guiding control policies elaborated by health authorities. Value chain analyses have provided an analytical framework to allow characterization of a part of the poultry industry as well as interlinkages among various actors in the industry. The work provides insights into the circulation of and dissemination of H5N1 viruses in China, and assists in the design of market surveillance activities and prioritization of market biosecurity upgrading investments.

Egypt

2011 Disease situation overview

The reported incidence of H5N1 HPAI in Egypt has not changed dramatically in recent years in spite of intensive efforts made by the Government of Egypt with support from FAO and other partners. The social changes, which began in January 2011, have complicated

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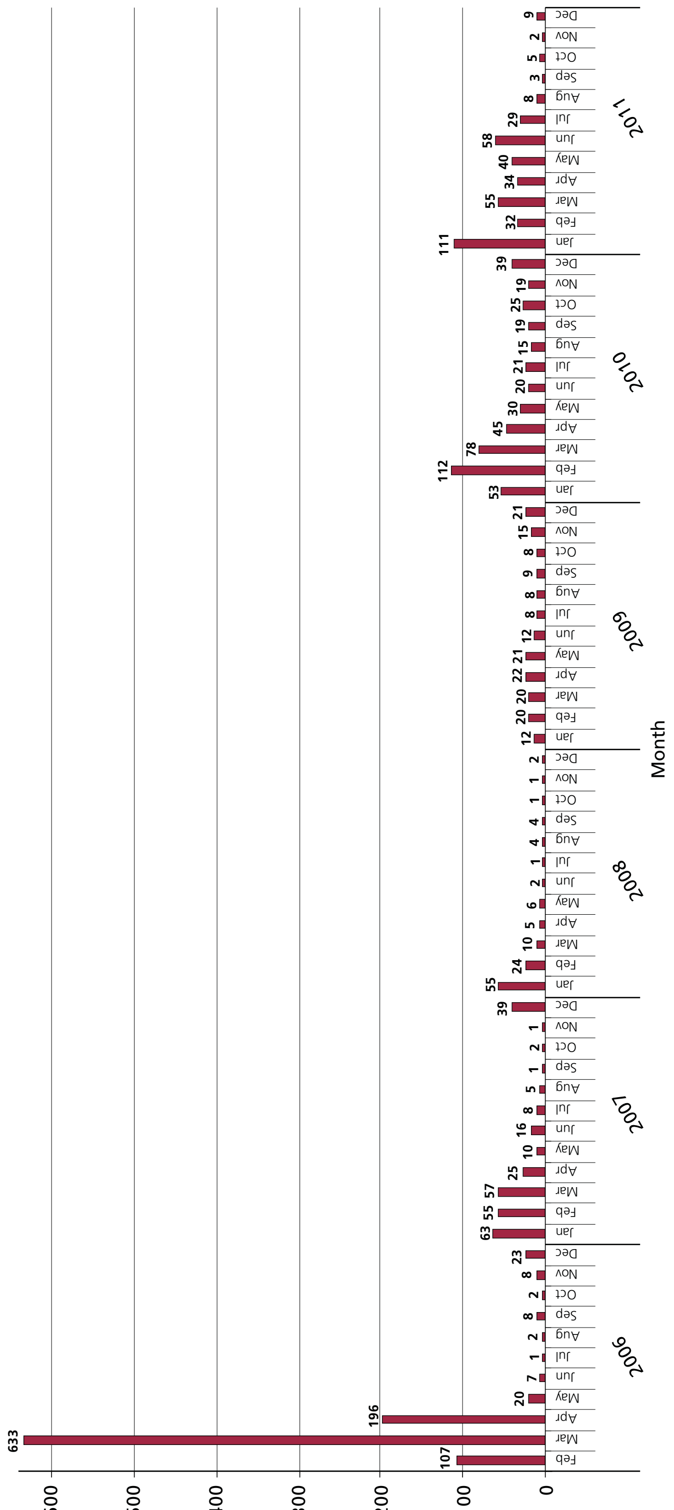
programme implementation further by slowing or disrupting the delivery of government services. **Egypt** continued to report large numbers of outbreaks predominantly in the household poultry sector during 2011 to January 2012 in most of its 29 governorates. Compared to 2010, the number of outbreaks reported has shown a slight reduction from 443 in 2010 to 378 in 2011, possibly due to reduction in surveillance activities as the result of civil unrest. In Egypt, detection of HPAI is the result of surveillance conducted in high-risk governorates by the FAO initiative of the CAHO programme, targeted surveillance in LBMs, as well as active surveillance conducted in the commercial and village poultry sectors. Egyptian viruses isolated in 2011 belonged to the 2.2.1 group (so-called classical or A group). Viruses belonging to the 'variant' or B group, now the fourth order Clade 2.2.1.1, were not isolated in 2011. The monthly distribution of the outbreaks in poultry for 2006 to 2011 is shown in Figure 3.5. Outbreaks were reported throughout the year, but, as in previous years and in other countries, there is a greater incidence of clinical disease during the cooler months. The distribution of outbreaks generally increases with the density of poultry and the spatial distribution of outbreaks in 2011, as is shown in Figure 3.6. The zoonotic potential of this virus poses a significant threat to public health in addition to continued food security and livelihoods concerns. During January 2011 to December 2011, there were 39 human cases of H5N1 infections reported and of these 15 (38 percent) were fatal. This result brings the total number of H5N1 cases since 2006 in humans to 167 with 60 fatalities (a fatality rate of 35 percent) over the period (Figure 3.7).

Current and Future Issues Overview

Egypt has large and dense poultry and human populations with most of the poultry farms located in the Nile Delta region. Poultry is a major source of animal protein and income. About 80 percent of commercial farms are not licensed, and a significant proportion of farms operate in rental facilities with little or no perceived incentive for biosecurity investment. Egypt is unique in the region for its large population of ducks. There are approximately five million ducks raised by the commercial sector and another 35 to 55 million in the household sector. Any HPAI programme must address biosecurity and the potential for ducks to act as a reservoir of influenza viruses.

FIGURE 3.5

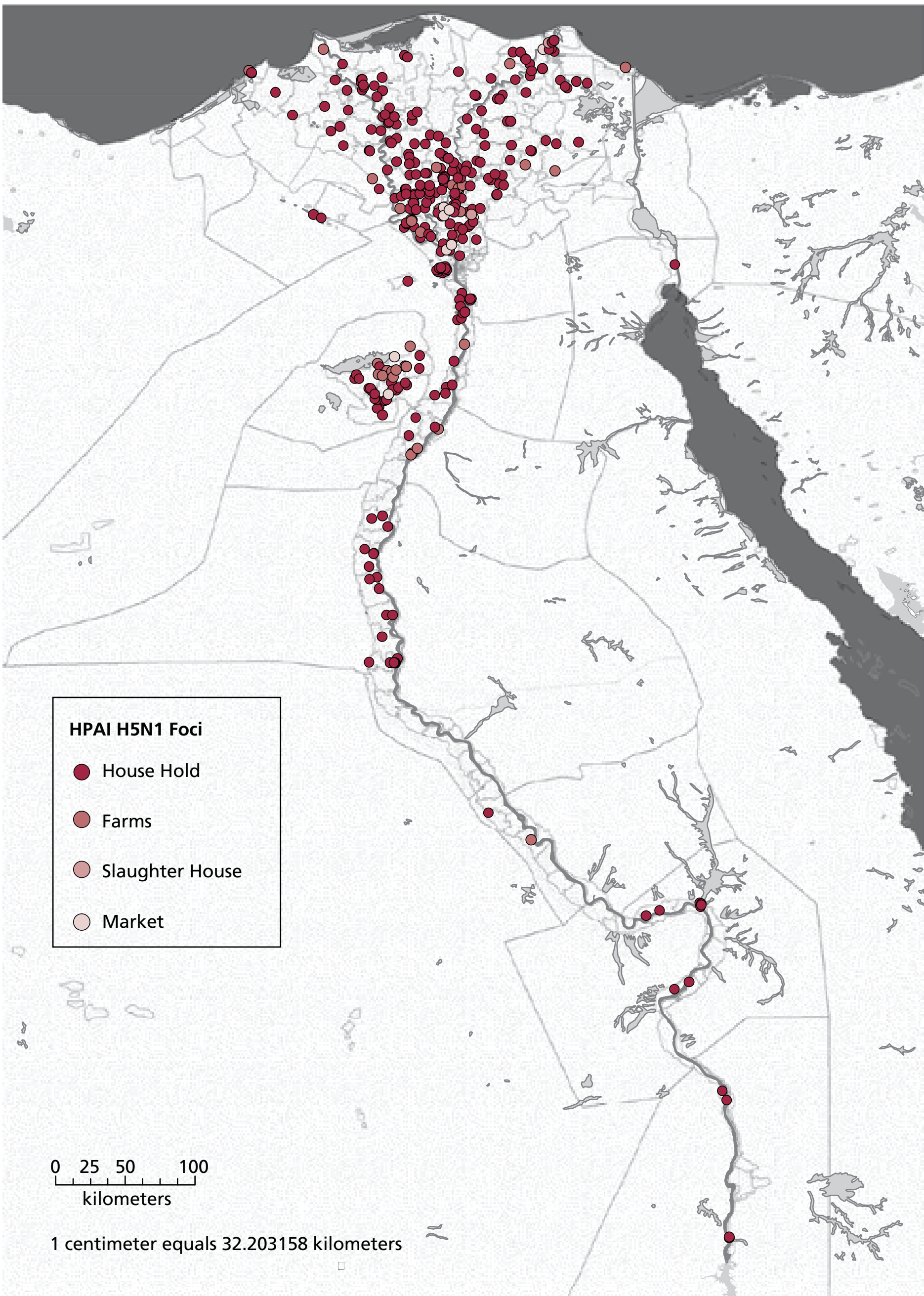
Monthly incidence of H5N1 HPAI outbreaks reported in Egypt from February 2006 to December 2011



Note: Total number of monthly reported HPAI outbreaks in Egypt: 2442. Total number of reported outbreak in 2011: 286.

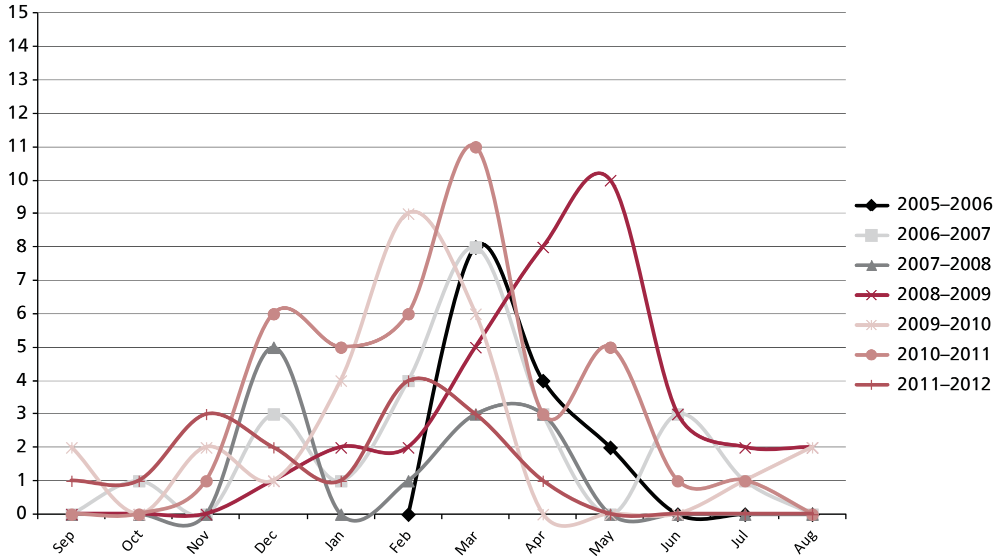
Source: FAO-EMPRES–i.

FIGURE 3.6
Spatial distribution of H5N1 HPAI outbreaks in Egypt 2011



Source: GOVS, Central administration for preventive medicine, Epidemiology department.

FIGURE 3.7
Monthly incidence reports of A/H5N1 HPAI human infections in Egypt (2006–2011)



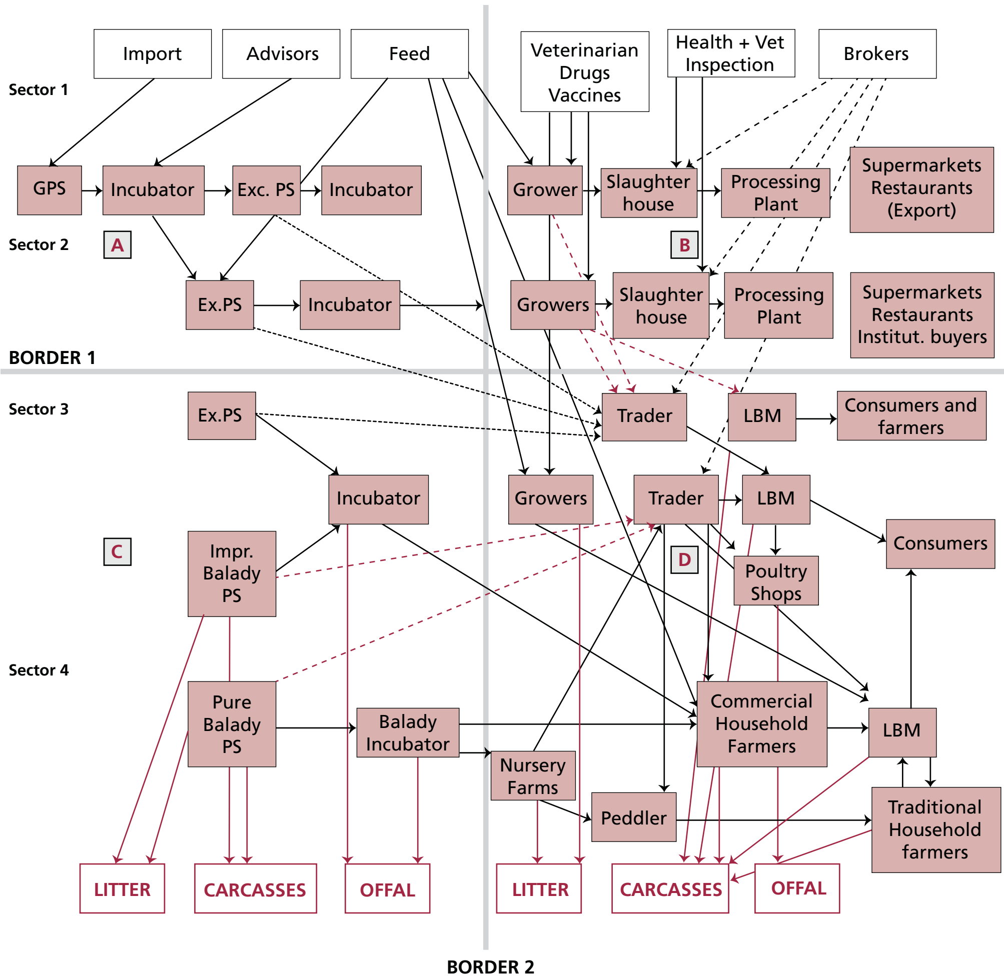
Source: FAO-EMPRES-i.

Egypt has 41 000 veterinarians, 12 000 of whom work in government. Many poultry farmers are reportedly reluctant to allow government veterinarians on farms. This reluctance is symptomatic of the changes shaking the social system in Egypt, including declining compliance with government regulations.

The HPAI surveillance system includes active, targeted, syndromic and passive surveillance. Syndromic surveillance is done by CAHO teams. There are 108 trained veterinarians or technicians in the CAHO programme, which is now fully integrated into GOVS. Since February 2011, there has been a decrease in most of the surveillance activities done by the MoALR with the notable exception of CAHO, which continues to function relatively well.

Vaccination continues to be a challenge in Egypt and it should not be considered the only tool to combat the disease. While there are over 20 commercial vaccines in use, none are produced in Egypt. Only one of the vaccines used in Egypt is formulated using an Egyptian isolate/genetic information, and the efficacy of these vaccines in protecting ducks is believed to be suboptimal. The selection of vaccines should be based on efficiency data. Also, postvaccination monitoring of vaccine efficacy in the field would improve vaccination strategies. There are some studies that suggest that current practices favor the emergence of variant viruses through vaccine pressure and production of partial immunity due to a mismatch between the vaccine strain and field strains. Findings also suggest that there is poor application of vaccines, the required practices in biosecurity of vaccination teams and postvaccination monitoring. Work is ongoing to identify vaccines that could be adapted to the unique Egyptian HPAI situation. If vaccination is utilized as a tool in Egypt for HPAI, the scheme needs to be implemented realistically so as to target poultry and/or duck sectors

FIGURE 3.8
Egypt poultry and duck value chain diagram



where vaccination will have a positive impact (instead of purported mass vaccination with suboptimal coverage). Vaccines appropriate to the virus clades circulating in the country should be used and the duck vaccine efficacy issues should be addressed thoroughly. An exit strategy should be included in the vaccination plan.

Since 2006, control activities have included stamping out (with and without compensation), movement control of animals and animal products, preslaughter testing and certification, and outbreak management using rapid response teams. FAO's contribution has included strengthening awareness among the human resources dedicated to disease management and institutional capacity for veterinary laboratories, improving epidemiological surveillance and professional skills, developing feasible biosecurity measures and promoting public-private partnerships. In 2011, assessments of biosecurity practices, the impact of biosecurity training, as well as risk at control points along poultry value chains have been accomplished (but these require reinforcement to ensure continued revision as these are often dynamic; changing between seasons and players). One important conclusion to come out of the value chain report was the need to develop a very specific national poultry and duck development policy. Subsequently, a comprehensive diagram of the Egyptian poultry and duck value chain was developed (see Figure 3.8). Field studies were conducted to understand the consumer preferences for poultry in Egypt as a means of forecasting trends in demands placed on animal health interventions in the future. Each of these has resulted in a better understanding of the people involved and the critical points for intervention.

The complexities of HPAI in Egypt and civil unrest bring continued challenges to this endemic country, and sick birds continue to appear in the marketplace. Future efforts should focus on implementation of progressive risk-reduction measures in a phased approach addressing strengthening surveillance, improving farm biosecurity as better management practice, strengthening public-private partnerships, adopting appropriate pro-poor animal health polices, promoting science-based planning and decision-making (including vaccination strategies), and strengthening the links between veterinary public health and animal health policies.

Indonesia

Disease Situation Overview

Indonesia continued to report a high number of H5N1 HPAI outbreaks in poultry during 2011. While there appears to be an insignificant reduction from the previous year (1 204 in 2010 versus 1 155 in 2011), outbreaks reported for Indonesia were greater than those for the rest of the world combined (see Figure 1.5 in Chapter 1). H5N1 HPAI is presently considered endemic on the islands of Java, Sulawesi, Sumatra and Bali, with sporadic outbreaks reported elsewhere (Figure 3.9). High incidence areas have been recognized in provinces on Java (especially Yogyakarta), Sumatra (Lampung and West Sumatra), Sulawesi (South Sulawesi) and Bali, with only one of Indonesia's 33 provinces (Maluku) having never reported the occurrence of H5N1 HPAI. In the first months of 2012, both national and industry partners have reported a reduction in outbreaks compared to previous years. The decrease in virus circulation in the commercial sector is also reflected through environmental surveillance at LBMs in the greater Jakarta area (see Figure 3.10).

The transparency in outbreak reports is partially attributed to the implementation of FAO's PDSR programme, which targets village poultry production systems (mainly backyard) and reports outbreaks at the village level (see Figure 3.11). To date, viruses only from clade 2.1 have been found to circulate in Indonesia, with the majority belonging to the established and continually expanding 2.1.3 sublineages.

Current and future issues overview

Laboratory

Work conducted under the OFFLU project in Indonesia resulted in technical recommendations on vaccination policy for the Government of Indonesia and in the cooperative development of a sustainable process for virus monitoring. The national animal health laboratory network,

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in line with the OIE-FAO *OFFLU avian influenza vaccination guidance*[42] on seed strains which states that "all avian influenza vaccination programmes should have an epidemiologically relevant surveillance programme to check for emerging variants and representative isolates of AI viruses obtained should be assessed for genetic and antigenic variation", has three main objectives: 1) identify potential virus variants; 2) monitor efficacy of H5 vaccines used for poultry; and 3) ensure relevance of existing challenge strains for vaccine registration.

The Influenza Virus Monitoring Laboratory Network for Animal Health (IVM-AH) is composed of national animal health laboratories that participate in virus detection and isolation, and conduct initial antigenic profiling through haemagglutination inhibition testing using a specialized panel of reference reagents selected to represent known variation in circulating viruses. Targeted viruses are submitted for further antigenic and genetic characterization to inform the ongoing field situation and to ensure that the challenge strains used for testing poultry vaccines are relevant. These efforts have resulted in the successful collaborative characterization of H5N1 viruses and sharing of data in the public domain.

Commercial poultry health

Because vaccination efforts in Indonesia for the commercial sector are not formally supported nor coordinated by the government, there is a need to engage industry as a major stakeholder and to strengthen ties through public-private partnerships. The Directorate of Animal Health and FAO have engaged with the commercial sector on best practices for disease control, and through the use of a participatory approach, have gained valuable insights regarding vaccine selection and application in the commercial sector. Presently, the majority of vaccines used by the commercial poultry industry are based upon local H5N1 strains and purchased through self-funded programmes. Increasing cooperation with the commercial poultry sectors and increased usage of more effective AI vaccines by commercial poultry farmers appears to be contributing to the improving HPAI situation in the historically endemic areas. Additionally, a biosecurity cost-effectiveness study on layer farms continues to provide valuable evidence and insights on how risk to HPAI can be further reduced and farm profitability increased.

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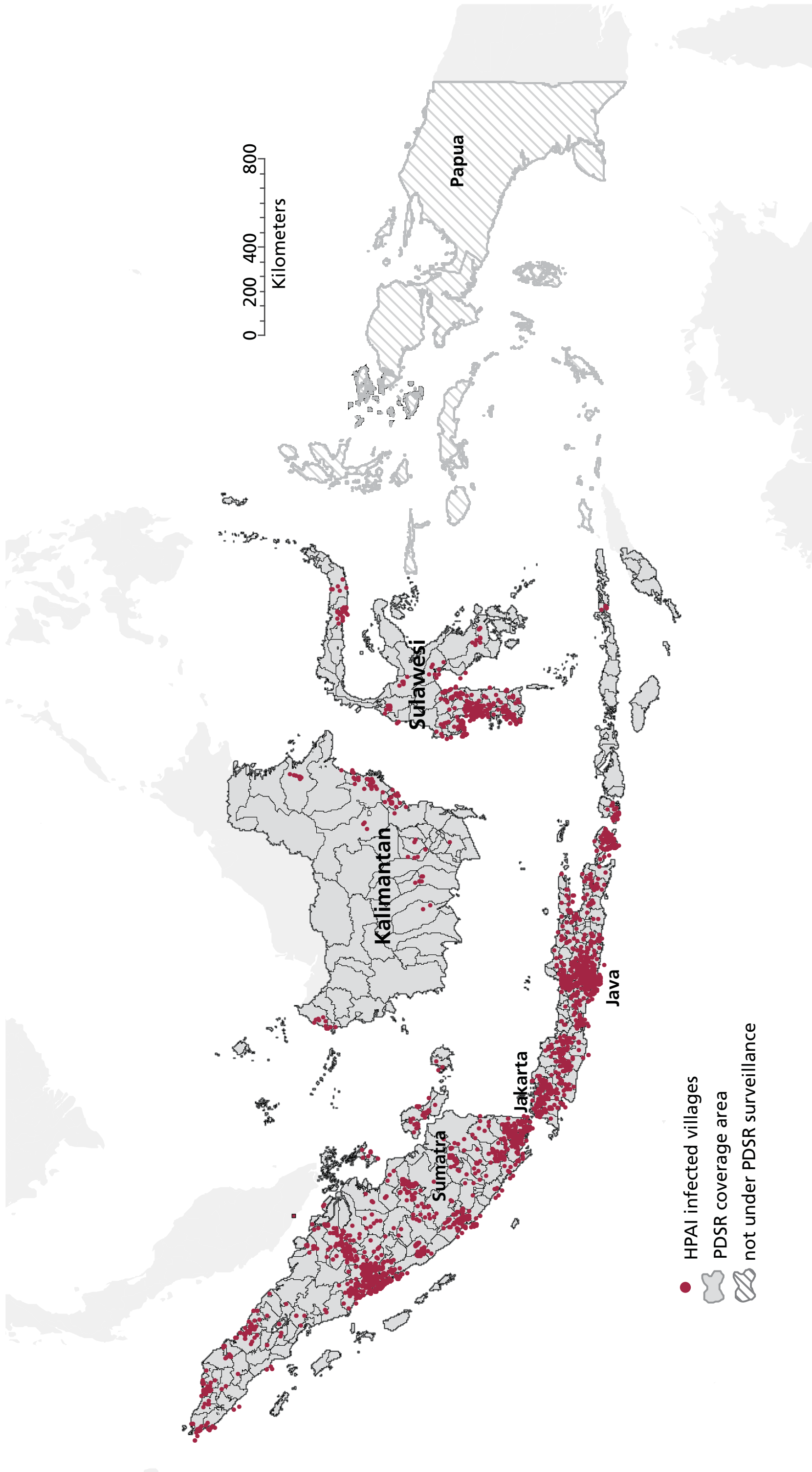
[42] Available at http://www.offlu.net/index.php?id=104

FIGURE 3.9
H5N1 HPAI spatial distribution in Indonesia 2011



Source: PDSR database: 01 Jan. 2011 – 31 Dec. 2011, SMS Gateway: 01 Jan. 2011 – 31 Dec. 2011.

FIGURE 3.10
Percent H5-positive at LBMs in greater Jakarta by month March 2009 to December 2011

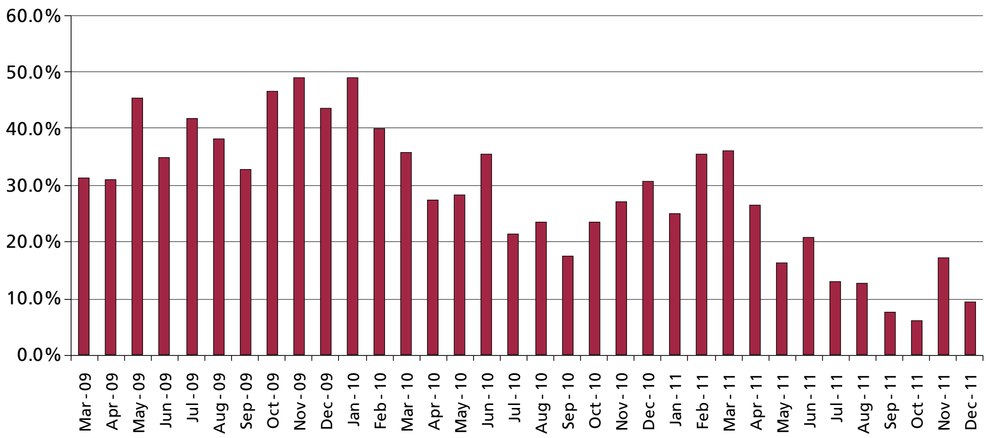
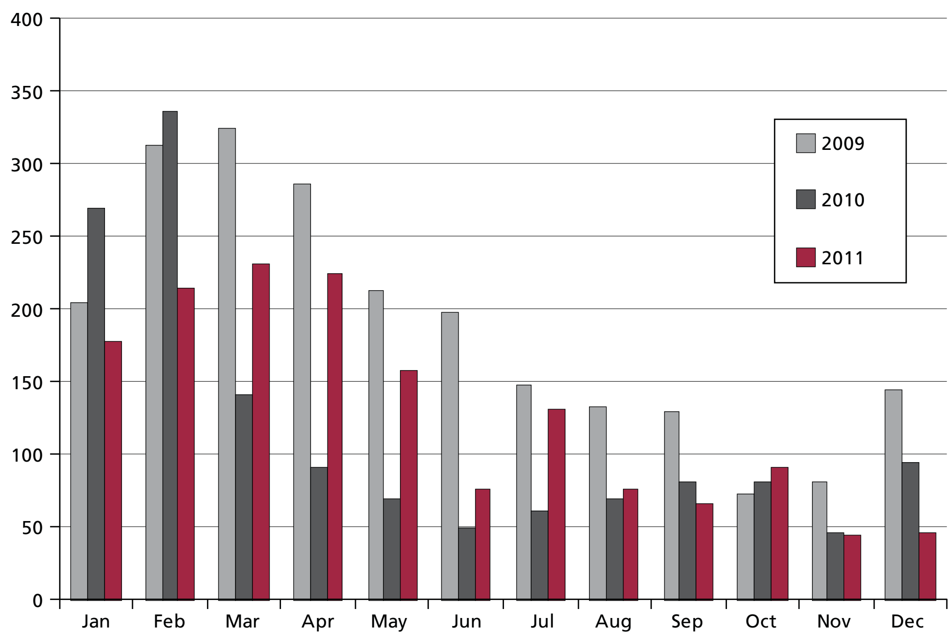


FIGURE 3.11
PDSR HPAI surveillance case numbers 2009–2011



Source: FAO PDSR.

Market chain

Engagement with stakeholders along the post-production market chain continues to identify areas for control interventions as well as ongoing monitoring of the national disease control impact via LBM environmental surveillance. Future efforts along the market chain will be specifically targeted at high-risk virus amplifying or virus-spreading activities, such as the long-distance trade of native chickens from central and east Java to meet increasing demand in Jakarta.

Long-term strategy

The most significant change facing the Indonesia HPAI control programme is how to maintain current momentum in controlling the disease in the face of dwindling international aid and a decentralized governance system, which hampers funding and coordination of the nationwide programme. Specific efforts are underway to identify those interventions that have had the most impact on HPAI control to ensure they are transitioned to government-funded programmes in the coming years, while continuing to build trust with the commercial poultry industry for better HPAI prevention and control within the commercial sectors. To increase sustainability of local government disease control efforts, a fully revised PDSR system is currently being rolled out throughout Indonesia. The integration of HPAI control activities with the control of other priority animal diseases, such as rabies and brucellosis, is being piloted under the National Veterinary Service (NVS) programme. NVS is a Government of Indonesia-led initiative, which helps enact the 2009 national law No. 18 on Livestock Production and Animal Health. That law establishes the veterinary authority at all levels of government for prevention and control of animal diseases. Transition from an HPAI-only focus to a NVS foundation broadens the platform established by the PDSR system to enable the government to address other disease threats which may emerge in the future.

Viet Nam

Disease Situation Overview

In Viet Nam, initially the epizootic of H5N1 in poultry was severe with the disease widespread across the country at the time of its first reporting in January 2004, but predominantly in the Red River Delta and Mekong Delta. Since the introduction of vaccination in late 2005, the incidence of disease was reduced markedly from that seen in 2004 and 2005. Most importantly, the incidence of human cases of H5N1 was simultaneously reduced and there was a period from 2006 to May 2007 when no human cases were reported. In 2011, there were no reported human cases, as compared to late 2009 and early 2010 where there was an increase in the incidence of human cases. There were five cases with five fatalities in 2009, seven cases with two fatalities in 2010 and one fatal case was reported in early January 2012. The total number of human cases of the disease since 2003 was 120 with 60 fatalities. In 2011, the pattern of outbreaks in poultry has been similar to other years with a small rise in the cooler months and a reduction of outbreaks through the hotter, middle months of the year (see Figure 3.12).

Between January 2011 and January 2012, the DAH in Viet Nam officially reported 55 H5N1 HPAI outbreaks in 22 of 64 provinces (34 province-level prevalence) involving ducks and chickens in northern, central and southern areas of the country. This result is com-

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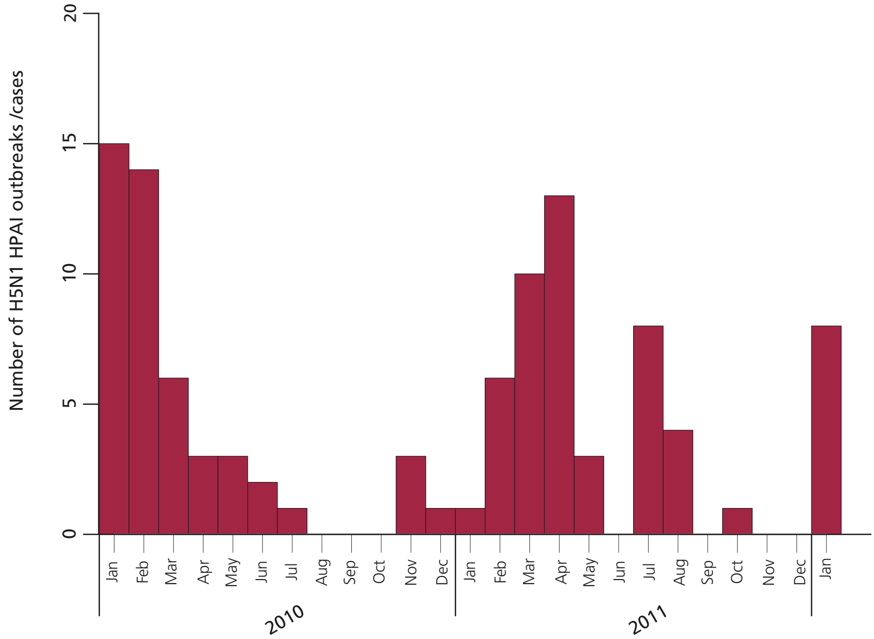
parable to that observed in 2010 with 21 out of 64 provinces affected. Surveillance and molecular genetics analysis have indicated the presence of four circulating virus clades in Viet Nam since 2003. These are: (1) clade 1.1 (predominant in southern Viet Nam from 2004 until now; (2) clade 2.3.4 (predominant in northern Viet Nam from 2007 to the first half of 2010); (3) clade 7 (detected in poultry seized at the Chinese border and at markets near Hanoi in 2008); and (4) clade 2.3.2 (detected in 2005 for the first time with additional detection in late 2009). Virus clade 2.3.2.1 has become predominant in northern Viet Nam since late 2010 until now. It was also detected in the south-central area of Viet Nam. In a vaccine efficacy trial, it was observed that the current vaccines in use in Viet Nam provided poor protection against one particular virus strain within virus clade 2.3.2.1. This virus strain forms a distinct cluster from most of the other virus strains of clade 2.3.2.1 in the HA gene phylogeny. This strain was detected in seven northern provinces of Viet Nam during the period 2011–2012.

Current and future issues overview

In 2011, Viet Nam temporarily halted government-sponsored vaccination in the northern and central areas of the country in response to the emergence of the new clade variant of H5N1 virus (2.3.2.1), when the vaccine in use was found to be ineffective. However, vaccination continues in the south and an emergency stock of vaccine for ring vaccination is maintained for use in the country. The government has financial priority resourcing issues with continuing its previous vast vaccination campaign, although if there were an upsurge in human cases the programme would likely assume higher priority. It is not likely that the virus and vaccine testing would continue without international technical support. Disease control measures include culling on infected farms, movement restrictions for 21 days and government compensation. There has been limited progress in fostering public- private partnerships (PPP) to support biosecurity or the instituted HPAI control programmes. Obstacles include policy uncertainty over small-scale commercial producers for whom fostering PPPs arguably hold the most benefits, and limited experience within government of PPPs (particularly for products destined for domestic markets). Most attention has been focused on collaboration between large international companies and government and the establishment of a

FIGURE 3.12
H5N1 HPAI outbreaks in poultry in Viet Nam, between January 2010 and December 2011



Note: 2009 – 2010 refers to the period 1 July 2009 to 30 June 2010.
Source: FAO EMPRES-i.

production zone with plans for higher disease prevention. A zonal approach to HPAI control strategies is being proposed, which recognizes significant differences in both the poultry population at risk and the epidemiology of infection within those separate populations. Zone-specific approaches would be applied to address endemic and incursive HPAI infection.

The FAO/USAID-funded Gathering Evidence for a Transitional Strategy (GETS) for HPAI H5N1 Vaccination in Viet Nam project has provided crucial epidemiological evidence of H5N1 AI in ducks through a longitudinal sentinel study, two market surveys and a modified post-vaccination monitoring programme carried out in five provinces of Viet Nam. The sentinel study, which monitored duck flocks during a period of over one year, detected H5N1 infection rate of 1.1 percent. This study also showed differences in H5N1 infections in ducks in the Red River area (only detected at the start of the project December 2009–January 2010) and Mekong provinces (where infections were detected throughout the year). In most cases, infections occurred without concomitant clinical signs, which limit a farmer's ability to detect possible HPAI cases based on clinical surveillance alone. Results from market surveys carried out in January and May 2011 resulted in an overall H5N1 pool prevalence of 4.5 percent (January 2011) and 2.1 percent (May 2011). No evidence of H5N1 was detected in the two Red River Delta provinces surveyed, but in the Mekong provinces the prevalence was 9 percent and 4.3 percent in the surveys.

Cross-border market chain studies have been very useful in illustrating that border controls are not effective in the face of a significant economic driver of trade and that a more strategic approach to managing the inevitable inflow of product is more effective in mitigating risks. FAO has facilitated bilateral discussions with China to look at the cross-border trade in spent hens and the potential risks this poses to the poultry sector in northern Viet Nam. Establishing a dirty corridor, or birds destined for slaughter before entry, was identified as one option for reducing the high HPAI disease incursion risk from the informal import of spent hens.

Other issues include the need for adequate investments on a long-term basis in the livestock sector, improvement of the entire poultry production chain to reduce the risk of disease outbreaks and spread, and further strengthening of human resources at all levels of professional service delivery. Targeted risk-based surveillance at critical control points associated with various aggregation points will need to be continued with the data analysed in real time to provide early warning of increasing prevalence of infected poultry, in particular, ducks.

FAO STRATEGY FOR NON-ENDEMIC REGIONS

FAO's collaborative HPAI global programme has significantly contributed to limiting the impact of the disease, establishing stronger national systems and strengthening regional coordination for disease preparedness, prevention and control. With the continuous support of the international donor community, national governments, regional and international organizations, development agencies and international development banks, sustained coordinated action has progressively reduced the number of countries affected by H5N1 HPAI. This result was achieved by assisting national veterinary services to develop preparedness and contingency plans; improving surveillance systems; acquiring laboratory resources and disease diagnosis capacity and proficiency; developing response capabilities, communication and awareness; and promoting biosecurity in areas of primary production and along the value and market chain. As with all H5 and H7 viruses of animal origin, H5N1 HPAI is an internationally notifiable disease. When there is an outbreak in a non-infected country, emergency measures should be implemented which usually includes culling of infected and at-risk birds (with due compensation), quarantine, protection and surveillance zones, traceback/traceforward investigations and standstill orders of all poultry movement from potential contaminated premises. Commercial poultry production currently employs strict biosecurity measures on farms as one of the key measures of prevention (bio-exclusion).

Africa

The H5N1 HPAI situation on the African continent must be considered a success story especially with the elimination of the disease from the family holdings to the commercial poultry sector in Nigeria and other countries in western Africa. While the origins and risk factors for introduction of the disease are not entirely known (migratory birds and risky commercial practices), there is probably more awareness in the commercial sector about high-risk activities, which might result in incursion, and so there is a reduced chance of an adverse event. The risks associated with the introduction of the disease in wild birds still remain, but it would appear that with fewer wild bird die-offs related to H5N1 being reported, the rate of infection in these populations might be declining for the present. However, FAO is committed to continue the global activities (if funding is maintained) to monitor the presence of H5N1 infection in migratory and select resident wild birds. If an increase in wild bird infections is detected then the high-risk sites in West Africa will be alerted.

Central Asia and the Middle East

FAO activities for the Middle East were managed through the ECTAD office in the Regional Animal Health Centre in Beirut. At the present time, this office is not operational because of lack of funds, but it is anticipated that it will reopen in the near future. The office operated a regional laboratory network and also provided a hub for training in animal disease surveillance. FAO plans to continue these activities as a means to maintaining HPAI awareness in the region.

For Central Asia, the original ADB project was completed and FAO used funds available for global initiatives to undertake further regional activities. The main approach – as a result of the relatively basic level of the veterinary services – has been to build regional networks and to use these as the springboard to deliver training in the various countries through a training of trainers (TOT) approach. The use of national consultants is important here because of the number of different languages spoken in the region. The WB-funded projects are continuing at country level and the FAO regional project supports these where possible.

High-risk countries

Countries which border the endemic countries or which form part of the agro-ecological zones in Asia, in general, have significant support from international sources managed through FAO, or, in some cases, fund substantial programmes from national budgets (e.g. Japan, the Republic of Korea and Taiwan POC in East Asia; and Malaysia and Thailand in Southeast Asia). In the case of India, West Bengal is considered to be endemically infected, but the Government of India meets all the control costs from national sources. In October 2010, a project commenced with India to strengthen the epidemiology capacity in the country, principally with the goal of better understanding disease dynamics and making disease control more efficient and effective. In Nepal, there are two projects operating: the USAID-funded project and the WB-funded project. At present, there is a small amount of WB funding in Bhutan, but it does not involve FAO in implementation. While Bhutan only has a small poultry population, because of the dependence on other regional neighbours for supplies, there is a moderate likelihood of an outbreak. The situation in Myanmar is probably more volatile than the other countries in the Gangetic Plain as it is now considered that some duck populations might be endemically infected. The disease, however, is not endemic in the domestic chicken sector. In the Greater Mekong subregion, there are now indications that the disease is becoming endemic in the Lao People's Democratic Republic and Cambodia. In these two countries there are also areas where ducks are raised in free-range systems and these areas may harbour long-term circulating virus or may be particularly susceptible to virus incursion. While FAO is not currently active in the Philippines, there has been an appropriate level of investment to prepare the country in the event of a disease outbreak incident.

With these three areas, FAO has a consistent approach to support countries either with country projects, in the case of the most at-risk countries, or through more broadly focused regional projects based on supporting regional networks.

Chapter 4
Lessons learned from H5N1 HPAI and applications of successes to support animal disease control

INTRODUCTION

Despite the significant progress made in controlling HPAI worldwide, the disease continues to be a human pandemic threat and influenza viruses, in particular, require a continued vigilance. It is anticipated that outbreaks will continue to surface in certain endemic areas of the world (Bangladesh, China, Egypt, Indonesia, Viet Nam and parts of India). H5N1 HPAI continues to be a major concern globally, regardless of a slight decrease in the overall number of infected countries/territories in 2011. There is mounting evidence of increasingly active bi-directional swine/human influenza virus genetic exchange in the form of reassortment of H3 and H1 viruses. The genetic diversity of Influenza A viruses in domestic animals and humans is on the increase, posing pandemic threats, particularly in eastern Asia. Meanwhile avian influenza programmes will continue to need to adapt to a world with decreasing donor funding and decreasing political and public interest.

The approach to HPAI response has evolved significantly since 2005. While FAO continues activities at four levels (global, regional, national and local), experience has shown that, especially in areas where the disease has become entrenched, an emphasis on local approaches, placed in a regional context, is more beneficial to a successful HPAI response and to the people whose livelihoods and lives are affected. In fact, FAO's HPAI programme has shown that the success of any global strategy for animal diseases is measured at the local level and that global strategies must take into account local circumstances, livestock production and marketing practices, demographics, customs and traditions, economies and governing structures.

Knowledge gained continues to assist non-infected and at-risk countries to prevent and prepare for HPAI, while allowing targeted approaches for endemic countries and regions where elimination from the poultry sector remains the long-term goal. No single measure can solve or eliminate HPAI. It requires a balanced mix and integration of various tools including, but not limited to, a systems approach and strong underlying coordinated prevention and response framework; strong partnerships at all levels; targeted surveillance; good veterinary capacity; sufficient laboratory and diagnostic capacities; adequate biosecurity; effective vaccination schemes; and successful communication strategies. Adequately addressing HPAI and other diseases is also contingent on a strong political commitment, effective and well-structured veterinary services with adequate, sustainable resources and strong public-private partnerships.

This chapter will discuss some particular areas where FAO's HPAI response has generated lessons learned, tools or approaches that have improved not only the efforts regarding HPAI, but have been applied successfully and progressively to other diseases of significant impact. This chapter will also discuss how the transition is progressing toward promoting and applying the One Health approach to major global health issues. Analysing and addressing such challenges in a holistic manner overcomes barriers, eliminates the division of disciplines into subsectors, provides increased multidisciplinary, multi-sectoral analysis to better inform evidence-based policy and technical responses, maximizes synergies and provides for a more successful and sustainable result for all involved.

A SYSTEMS APPROACH AT THE GLOBAL, REGIONAL, NATIONAL AND LOCAL LEVELS

A major HPAI lesson learned is that a **systems approach**, beginning with a global framework, is needed for TADs to provide the coordinating basis upon which more targeted regional, national and local disease prevention, control, response or eradication plans are efficiently and successfully designed and implemented.

The threat of a global human pandemic, and the ensuing collective response demanded a global, cohesive, collaborative vision and supportive plan that continues to this day. Reactionary and disjointed responses to TADs exist in the absence of concerted, well-thought-out roadmap frameworks that provide the methodical and science-based supportive structure and guidance upon which sustainable and effective local, regional and global responses are based.

HPAI demonstrated conclusively the need for **global coordinated frameworks** that underpin national and regional plans/responses for TADs and zoonotic diseases. From the outset FAO took a lead role in global coordination, working with international partners to address successfully the pandemic threat. FAO continues this leadership today on influenza as well as other TADs. Pathogens and vectors do not recognize political or geographical boundaries and today's globalized world increases that reality. Animal movement, trade and human movement as well as endemic, emerging and re-emerging pests and diseases around the world will demand a continuing and improved level of globally coordinated infrastructure and discussion. This HPAI systems approach was further elucidated by applying a methodical systems framework approach to FMD, which culminated in the development of the FAO/OIE progressive control pathway for FMD (PCP-FMD) in 2011.[43] This approach is currently in process for other high-impact diseases such as brucellosis, CBPP, PPR and rabies (see Box 4.1).

FAO's HPAI programme also demonstrated a need for a systems approach at the **regional level** especially in regards to regional plans centring on communication, coordination, surveillance, and data gathering and analysis to better understand risk factors (drivers) of disease and trends.

[43] The PCP-FMD has been developed by FAO to assist and facilitate countries where FMD is endemic to progressively reduce the impact of FMD and the load of FMD virus. It is used as a working tool in the design of FMD country, and some regional, control programmes. In 2011, it became a joint FAO/OIE tool and it forms the backbone of the *The global foot and mouth disease control strategy – strengthening animal health systems through improved control of major diseases* published in July. For more information on PCP-FMD see http://www.fao.org/ag/againfo/commissions/en/eufmd/pcp.html

Regional laboratory networks are an example of where regional coordination has been applied effectively. These networks were built or supported significantly by HPAI projects and have proven to be the appropriate approach to strengthening the laboratory component for local, national, regional and global responses to HPAI and other TADs. These diseases can quickly overwhelm any local and national laboratory capacities and HPAI demonstrated that successful responses to these diseases require consistency, coordination and collaboration regarding diagnostic assays, quality control of samples and distribution of information. The high level of information and experience sharing, the positive group dynamics for training and meetings, the decision-making process on regional priorities for capacity-building and other developments are elements that keep supporting the pertinence of a regional approach for laboratory strengthening. Regional laboratory networks include annual meetings to discuss outcomes of proficiency testing, constraints and progress made, disease situations, working opportunities and projects. From these discussions collective decisions are made. In 2011, FAO conducted or supported annual regional coordination meetings in all regions[44] where FAO projects exist (North Africa, West/Central Africa, Eastern Africa, Southeast Asia, and South Asia). Linkages between regional laboratory networks and global specialized networks (e.g. OFFLU, global FMD, WHO's Global Foodborne Infections Network [GFN] and WHO's Emerging and Dangerous Pathogens Laboratory Network [EDPLN]) are often maintained during annual coordination meetings and on specific occasions. Several regional service laboratories that have been designated during the last five years are also supported through these networks and their roles and responsibilities are currently being more clearly defined and harmonized across regions. A good base of expertise now exists at the regional level in most regions at leading laboratories and could be better utilized in collaborations in the future.

Successful HPAI and TADs prevention and response efforts require a **national systems approach** within and between all relevant intergovernmental agencies (e.g. ministries of agriculture, health and environment).

Mirroring global and regional requirements, HPAI also demonstrated the need for broader and improved coordination at the national level. As such, FAO's activities have also centred on facilitating relevant collaborations at the local and national levels. For example, before the pandemic threat, in many countries, ministries dealing with agriculture, human health, wildlife, environment and food safety did not interact or work together. To deal effectively with HPAI at the national level, many countries put interministerial structures of coordination into place to enable a national systems approach to better respond to the threat. And while HPAI and the threat of a pandemic served as the impetus for initial or improved intergovernmental coordination and discussion at the national level, in many countries these alliances have evolved and now provide a lasting structure upon which zoonotic and other animal diseases are better addressed by governments. FAO and WHO simulation exercises in countries in Eastern Europe and Africa have assisted in interagency communication.

Additionally, cross-border collaboration among neighbouring countries has been expanded to include coordinated activities with public health partners, while pilot studies have led to the establishment of more effective, integrated working relationships and

[44] For more information see http://www.fao-ectad-bamako.org/fr/IMG/pdf/Report_5th_RESOLAB_Dec2011_Engl_F16Jan_GD.pdf

BOX 4.1
PCP-FMD

A stepwise approach is being promoted today for planning and executing control of infectious diseases in animals. This approach applies particularly to those zoonotic and TADs whose control or eradication is deemed to be a global public good or which restrain trade in livestock and livestock products. In this respect, FAO continues to target high-impact diseases and zoonoses, with development of regional roadmaps for progressive disease control. It works directly at the local level with countries and regions with national disease control programmes. A major novel initiative was the design of the PCP-FMD, and the associated regional roadmaps customized to the socio-economic and developmental circumstances in each region. This approach has been given increasing attention from the international community. FMD, because of its significant high impact on trade, is one of the four diseases with OIE disease-recognition status, and causes significant economic losses and inefficiencies in food production.

PCPs enable countries to set disease control objectives and determine the actions needed to meet those objectives. By using a risk-based, strategic framework, the drivers of disease and effective preventive measures can be addressed at a more fundamental level. By working with countries so that they define the actions they need to take, this approach can be tailored to each country's requirements for FMD control (and other diseases in the future), incorporating technical, socio-economic, livelihood and local level priorities. Control of TADs such as FMD requires a truly regional approach, as one country's efforts may be put at risk by the disease situation of a neighbour. For this reason, the regional roadmaps are a key tool to coordinate activities and build confidence. PCPs address control measures in a targeted fashion and improve the ability to measure the efficacy of the strategies adopted, helping to develop sustainable national strategies based on a realistic assessment of disease impact and of the control options available.

Ongoing PCP-FMD country-specific activities are planned to improve FMD disease control in the vulnerable sectors and at the national level by identifying achievable steps in the progression toward increased and sustainable disease control. To date, the FMD PCP approach is being utilized in country and regional progressive approaches in West Eurasia (the West Eurasia regional roadmap includes Afghanistan, Armenia,

(cont.)

coordination of surveillance strategies among partners. Surveillance efforts in swine, bats and people in Thailand, Viet Nam and the Philippines in 2011 are an example of integrated coordination. A cross-border collaboration example is the Mediterranean Animal Health Network (*Reseau Mediterranéen de Santé Animale*; REMESA). Set up in 2009 in the western part of the Mediterranean, REMESA includes the chief veterinary officers (CVOs) of ten countries representing the African and European shores (Algeria, Egypt, France, Italy, Libya, Morocco, Mauritania, Portugal, Spain and Tunisia) and creates a common framework

Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Islamic Republic of Iran, Pakistan, Tajikistan, Turkey, Turkmenistan and Uzbekistan), Africa (the East African regional roadmap includes Burundi, Djibouti, the Democratic Republic of the Congo, Eritrea, Ethiopia, Kenya, Rwanda, the Sudan, South Sudan, Somalia, the United Republic of Tanzania and Uganda) and the Andean region of South America. Additionally, project activities allow for further capacity to address those TADs which are the most challenging diseases for national veterinary services and those that need to be addressed on a regional basis. For example, the PCP-FMD approach in Afghanistan, Pakistan, Tajikistan, Turkmenistan, and Uzbekistan includes FMD and PPR. The PCP approach is being developed or explored for other diseases of global concern such as brucellosis, CBPP and rabies.

For more information on PCP-FMD see http://www.fao.org/ag/againfo/commissions/en/eufmd/pcp.html.

for work and cooperation. REMESA coordinates the development and implementation of animal health regional projects and programmes under four thematic subnetworks for: laboratories (RELABSA), epidemiology (REPIVET), communication (RECOMSA) and socio-economics (RESEPSA).[45] A FAO/OIE regional coordination unit in Tunis supports and assists the network through a technical and a secretarial role with FAO providing the REMESA

[45] For more information see http://www.remesanetwork.org/remesa/en/

secretariat in 2010 and 2011. In 2011, activities included technical assistance and support in emergency situations (e.g. RVF in Mauritania, needs assessment in Libya) and TADs and zoonoses capacity-building and harmonization (e.g. RVF, PPR, WNV).

APPLYING AND CAPITALIZING ON HPAI LESSONS FOR SUCCESS

The HPAI investments in frameworks and coordination at global, regional and national levels have had and will continue to have residual positive effects that transcend a particular disease threat and go beyond the interministerial collaboration in other areas. The following discussion will demonstrate how these efforts have paid off. Long-lasting dividends have been provided by the foundations built by HPAI efforts in areas such as national and regional laboratory capacity, veterinary infrastructure, surveillance, involvement of stakeholders and compensation, to name a few. For many, HPAI efforts also brought about the acknowledgment that part of a long-term successful disease prevention and response is the understanding of the drivers of disease, a better understanding of market forces and active involvement of all stakeholders throughout the process.

INVESTING IN ANIMAL HEALTH SERVICES

HPAI demonstrated conclusively that countries require sufficient and sustained investment regarding capacity and capability in veterinary personnel, infrastructure, tools and knowledge in order to respond effectively to and to prevent the endemic, emerging and re-emerging high-impact diseases in today's world.

The global efforts on HPAI brought to the forefront what many involved in the efforts on transboundary animal disease efforts had grappled with in the past. Animal health veterinary and laboratory diagnostic services, for various reasons in many countries, are not consistently well-resourced financially or otherwise, and they often lack sufficient personnel and adequate infrastructure. Additionally, the technical capacity of both government and private veterinary services is sometimes limited in key areas for disease prevention and control, such as epidemiological skills (investigation, surveillance and analysis) and laboratory diagnosis.

To that end, since the beginning of the HPAI threat, FAO and its partners have focused on providing resources and technical advice to increase and improve countries' veterinary infrastructure and capacity. These efforts benefitted participants/countries, by enabling them to share ideas, compare experiences and discuss solutions and response options so as to provide them with take-home messages, lessons learned and benefits. Specific examples of benefits include participation in international scientific standard setting, provision of continuing professional development and veterinary governance and assistance to countries in OIE's tool for the evaluation of performance of veterinary services (OIE PVS Tool). Countries have taken different approaches to disease control and prevention. Successful plans have been those with strong political commitment from the highest level of government and a superior level of professionalism throughout the integrated animal health systems.

It is clear that a country's investment in its animal health programmes/services must take place in a structured approach that is relevant to the needs of the stakeholders in animal production systems. It must have clear goals to provide defined public good outcomes and must report progress about them. While HPAI demonstrated that it is necessary to develop more holistic health services for smallholder poultry owners, covering entire communities and going beyond avian influenza, this lesson applies to other animal production sectors as well. Therefore, it is vital that countries include stakeholders in the process as they develop veterinary services and animal health programmes.

PREPAREDNESS AND CAPACITY FOR EMERGENCY RESPONSE

H5N1 HPAI re-emphasized the need for robust rapid emergency assessment and response in the event of high impact animal, plant and zoonotic diseases.

The CMC-AH has directly and indirectly contributed to improving countries' veterinary services capacity. The CMC-AH's **emergency assessment and response** has been a major component of FAO's HPAI global programme and has been expanded to assist countries with other emerging and re-emerging pathogens. In this respect, FAO has been able to provide immediate support to countries, enabling them to address HPAI outbreaks and contributing to successful elimination. Responding to country requests since 2008, the CMC-AH has deployed missions to address other disease events as well.[46] In 2011, key missions included a response to RVF in Mauritania, FMD in the Republic of Korea, ERV in Uganda and an investigation into white spot syndrome, a disease of farmed shrimp in Southeast Asia (see Box 4.2). In early 2012, the CMC-AH had undertaken missions in Libya and Palestine to assist investigations regarding the introduction of an exotic FMD virus.

A major lesson learned from the CMC-AH efforts is that few of the countries requesting assistance with major high-impact diseases have advanced preparedness and contingency plans. Even when they have developed diagnostic capacities, and/or existing field services, they have difficulty in harnessing their own resources.

To assist countries, a guide entitled *Good emergency management practice: the essentials* (GEMP)[47] has been produced and updated in 2011. As the global animal and human health challenges continue, the need remains for FAO to continue coordinating and supplying emergency assessment and response teams at country requests. The CMC-AH has evolved and is looking to better integrate its activities as well as to consider prevention and the development of preparedness planning as part of the continuum of services provided to countries. The CMC-AH can provide both immediate and longer-term development assistance to countries to better meet the needs of today and the future. Additional benefit would also be provided as the CMC-AH further progresses, working across agencies and disciplines to develop its client countries' resilience.

NATIONAL LABORATORY CAPACITIES

Part of an effective response to high-impact diseases is the ability of the national laboratory system to accurately and quickly diagnosis disease under a quality management system.

In addition to the regional laboratory efforts previously discussed, a great amount of progress has been accomplished in 2011 in terms of enhancing **national laboratory capacities**. This progress can best be elucidated by the following comparison in endemic hotspot areas. In 2005, the majority of the other laboratories in Southeast Asia region

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[46] For more information see http://www.fao.org/docrep/013/i1874e/i1874e.pdf and http://www.fao.org/docrep/014/al894e/al894e00.pdf

[47] Available at http://www.fao.org/docrep/014/ba0137e/ba0137e00.pdf. Related links to GEMP workshops and documents are available at http://www.fao.org/ag/againfo/programmes/en/empres/news_120112.html

BOX 4.2

Emergency response assistance to countries: RVF mission in Mauritania

From 7 to 17 January 2011, the CMC-AH deployed an emergency mission to Mauritania following an official request by the government for assistance to control an unexpected epidemic of RFV in the northern Adrar region. Never before observed in this type of Saharan ecosystem, the RVF epidemic caused the death of camels, small ruminants and humans.

The CMC-AH dispatched a team composed of experts in VBD epidemiology, diagnostic techniques, risk management, and laboratory networks. The mission was funded by USAID, the French Government and the Spanish Agency for International Cooperation for Development (AECID).

Through field work and collaboration with stakeholders, including national and regional human and animal health authorities, international organizations, NGOs and farmers' organizations, the team was able to identify the key epidemiological features of the epidemic, its instigating factors and evolution, and to propose an effective plan of action to eliminate it and prevent recurrences.

After analysis, the team formed the hypothesis that the virus had been introduced to the area through the movement of infected animals, most likely camels, from adjoining regions where the virus is endemic. Exceptionally heavy rainfalls in the northern region of Adrar from late September to early October 2010 impacted low-lying areas, leading to the explosion of the mosquito population and creating favourable conditions for the amplification of the virus in human and animal populations.

The team provided direct technical support including laboratory work and, after commending the government for its efficient response in the face of this difficult and unexpected situation, elaborated a number of recommendations to consolidate the management of the epidemic in the areas of organization, surveillance, methods of treatment and laboratory work.

Recommendations included: the elaboration of a short-term contingency plan by the government at the national, regional and local levels to fight RVF, followed by the creation of a committee, under the joint direction of the ministries of health and rural development, to manage zoonoses over the medium term; the ongoing observation of the dynamics of populations of mosquitoes; the creation of a system of sero-surveillance in major slaughterhouses; communications campaigns to inform the population about the modes of transmission of the virus; and the design of more efficient transport systems for laboratory samples.

The team also worked with the United Nations Central Emergency Response Fund (CERF), WHO and UNICEF to draft a programme providing the Government of Mauritania with additional financing.

had very low capacity for diagnosing H5N1 HPAI. Since January 2011, HPAI diagnosis and confirmation have been carried out by all national laboratories in endemic areas. Samples and testing are now handled in a biosecure environment and under a quality management system. Additionally, the laboratories' capacities for the differential diagnosis for other avian diseases such as Newcastle disease virus have been expanded.

Meeting the multiple animal health and zoonotic disease challenges of today and the future will require FAO to expand laboratory support to a broader range of priority diseases so that the capacity of animal health laboratories to detect and diagnose diseases under a quality management system is enhanced for all diseases of national, regional and global significance. Specific areas requiring future focus are biosafety training and standard operating procedures (SOPs), establishing guiding principles for other national and regional priority diseases and developing creative and strategic approaches to expand utilization of molecular methods through routine application to pathogens in addition to AI. Hurdles also remain for improving laboratory biosafety for facility management and engineering aspects due to budget constraints for maintenance and equipment, personnel and technical expertise.

The major investment made in national laboratories has been in terms of laboratory supplies and training. However, investments have also been made in laboratory networking, through the establishment of regional laboratory networks in several regions, especially in Africa and Asia. This investment will be lost in many places if efforts are not sustained to support laboratories in the many components that extend beyond supplies and training in diagnostics. Deficiencies in the capacities and capabilities of laboratories may lead to inadequate responses to disease management at the animal-human interface and in animals. As part of efforts to address these deficiencies, FAO developed a tool to aid in laboratory assessment: the FAO laboratory mapping tool. In collaboration with national partners, this tool aims to determine the status, gaps and progress made in laboratory functionality so as to facilitate the definition of mechanisms and targets for capacity-building to fill these gaps. The tool assists laboratories to ascertain their ability to receive and appropriately handle sample submissions, to correctly diagnose, maintain records and report on animal diseases; hence, to detect existing or emerging disease threats. Laboratory external and/or self-assessments were conducted with the laboratory mapping tool in 2011[48] and initial data analysis and reviews were conducted in each region in Africa and Asia (see Box 4.3). This tool was part of the tripartite (FAO, OIE, WHO) IDENTIFY component of the USAID-funded EPT Program initiated at the end of 2009. It seeks to strengthen national laboratory capacity for rapid, accurate and sustainable detection of targeted diseases in hotspot regions defined as those where the risk of emerging human and/or animal diseases is highest. These regions have been identified as the Congo Basin in Central Africa and countries in South and Southeast Asia, where, respectively, 12, 11 and 3 laboratories are partially supported by FAO. This project not only provides the opportunity to keep momentum in the support provided to laboratories in previous AI projects, but also has enabled the development of an advanced framework for veterinary laboratory strengthening. The two outputs of this laboratory strengthening framework, consolidated in 2011, are: (1) to improve the ability of beneficiary laboratories to diagnose priority diseases; and (2) to involve laboratories in

[48] EMPRES Transboundary Animal Disease Bulletin No. 40 (available at http://www.fao.org/docrep/015/i2811e/i2811e.pdf).

BOX 4.3

Profiling laboratory capacity in the context of emerging pandemic threats: The FAO laboratory mapping tool

Description of the FAO laboratory mapping tool

The FAO laboratory mapping tool is based on a standardized format that allows data to be captured by either external evaluators or through self-assessment. In general, the tool is designed to facilitate the assessment of laboratory functionality in a systematic and semi-quantitative manner (with particular focus on capacity and capability to respond to regional priority diseases determined under the IDENTIFY project). Initially, two slightly different versions of the tool were developed and piloted in three regions (South and Southeast Asia and the Congo Basin in Africa), and feedback was collected for continued improvement of the tool. Efforts have since been made to harmonize the two versions into a single tool that can be used in any region. Thus, it can be useful for generating knowledge of laboratory functionality across regions, in particular, from the perspective of investment needs, risk modelling of disease emergence and spread.

The most recent and harmonized version of the FAO laboratory mapping tool comprises five modules: (i) general laboratory profile; (ii) infrastructure, equipment and supplies; (iii) laboratory performance; (iv) quality assurance and biosafety/biosecurity; and (v) laboratory collaboration and networking. A total of 18 categories and 94 subcategories have been selected for all of these five modules. These elements are thought to be fundamental for optimal description of laboratory functionality. Each of the 94 subcategories includes four clearly defined options, which correspond to scores from zero to three. An explicit questionnaire is used to collect data (94 scores from zero to three obtained), and an overall as well as a summary score per category is generated for each laboratory. The score is used to assign a given laboratory into one of three levels of functionality: basic, moderate and advanced.

Flexibility

This tool can be used as a whole, or in parts by focusing on just one or more of the modules (e.g. during on-site expert missions on quality assurance and biosafety).

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networks and networking. In 2011, FAO trained 44 people in Africa and 52 people in South and Southeast Asia under the IDENTIFY project. Also, a few innovative approaches have been initiated, such as a) allowing laboratory directors to visit each other's facilities through a study tours programme; b) developing partnerships between national laboratories and the private animal production sector; c) providing access to African laboratories for sequencing services and proposing multi-diseases molecular kits and protocols; d) establishing a four-way linking framework (see Box 4.4); and e) developing the EMPRES-i genetic module (see Box 4.5).

Furthermore, external and/or internal assessors can apply the tool and findings can be compared over time. The tool also helps regional service laboratories to devise strategies to contribute to the improvement of other laboratories within the network.

Pilot use of the laboratory mapping tool

The tool was applied in 2010/11 (under the IDENTIFY project) in three areas (South Asia, Southeast Asia, Congo Basin), where 12, 11 and 3 laboratories from 11, 9 and 2 countries were analysed, respectively. The initial application of the tool made by external assessors (Asia) and internal assessors (Africa) provided the baseline information to categorize the laboratories in the project and map the national and regional strengths and weaknesses. Functionality of the laboratories was categorized as basic (n=5), moderate (n=15) and advanced (n=6) across the three areas. The main constraints for the majority of laboratories assessed could be summarized as follows: (i) low operating budget of the laboratory from the national government; (ii) prohibitive costs for equipment, maintenance and reagents; (iii) difficulties to ensure biosafety and biosecurity; (iv) inadequacy of human resources both in skills and number; (v) insufficient sample flow to the laboratory to justify maintenance and operating costs; and (vi) limited access to up-to-date information through scientific publications. Linkages between the tool and the USAID/FAO monitoring and evaluation (M&E) have been established in order to give a clear picture of the project's progress and impact on laboratory functionality.

Next Steps

Further assessments by internal or external experts will be carried out with the same mapping tool in the same laboratories. The application of the tool in three areas enables assessment of a large number of laboratories on a standard basis, and evaluation of the strengths and weaknesses over time at national and regional levels. Results will serve to measure progress and target needs for improvement. They may also serve as advocacy material, and will be useful for decision-makers, donors and national bodies. It is proposed to apply this tool wherever possible and to scale-up its use to other regions, as has already been the case in North Africa and South America. The countries themselves may also use it to assess their status. The FAO laboratory mapping tool will be developed to allow independent application of specific modules that are directed to assess capacity for a particular disease or to specifically measure the project´s impact on laboratory functionality.

SURVEILLANCE CAPACITY

Risk-based surveillance

A strategic, targeted and more comprehensive approach to surveillance is used to inform decisions which, in turn, lead to improved results.

Surveillance of HPAI and other diseases has progressed from reactive, general surveillance to a risk-based, targeted approach. This approach looks beyond the silos of a specific animal disease to include other data in a country or region in order to forecast and mitigate

BOX 4.4

Four-way linking of epidemiological and virological information on human and animal influenza: a tripartite initiative

Successful management and containment of HPAI depends on the ability of the animal and human health sectors to work together before, during and after the outbreaks, by efficiently managing epidemiological and virological information. Although the coordination between public and animal health sectors, as well as the awareness of the need for good coordination, has improved in recent years in many countries, major efforts are still required by the different actors at the human-animal interface (HAI).

Collaborating Towards One Health

The four-way linking framework is a collaborative effort among WHO, FAO, OIE, OFFLU and GLEWS to improve national, regional, and global qualitative risk assessments for animal and zoonotic influenza. This framework seeks to establish a mechanism at the national level for routine integrated qualitative assessment of virological and epidemiological influenza data from humans and animals (i.e. from four different national sectors). This framework involves collecting and sharing relevant epidemiological and virological information between the sectors and linking information for joint assessment by experts of the four national sectors. It would allow improved understanding of the overall situation, including animal and public health risks from influenza, to identify gaps in the available information or national systems. Once in place, the four-way linking framework could act as a supportive national platform upon which internationally mandated capacity-building and other national-level projects and activities designed to improve the systems, could be aligned. In addition, information from risk assessments generated by this framework can be used by decision-makers to develop and implement new scientifically-based measures to prioritize, manage or control the risks identified, as well as to evaluate the effects of those measures already in place.

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diseases before they spread beyond a local occurrence. Intensive and focused HPAI surveillance is particularly essential in high-risk areas such as those with a high poultry density (especially those with a large free-grazing domestic duck populations), in situations where wild waterfowl and poultry frequently come into contact and in wet markets or along market chains where HPAI has been previously detected.

FAO disease surveillance is also supported by a newly adapted programme that falls under the USAID-funded EPT Program, established in 2009 to expand upon the lessons learned in combating the global H5N1 HPAI pandemic. The new EPT Plus Program will reflect the honing of FAO's surveillance of influenza viruses over the years, which now increasingly focuses on monitoring for pathogens with pandemic potential in the mixing of crowded human populations with domestic pigs, domestic poultry, wild waterfowl and farmed ducks. The programme will also monitor major hubs of contact where, if people

Process

This tripartite initiative implies three main steps: (1) an expert mission to identify key partners, national initiatives, efforts, and operational tools and systems in place for epidemiological and virological surveillance for influenza in both the public and animal health sectors, and to assess the gaps in the available information and areas for relevant national risk assessments; (2) a national workshop to describe the gaps and define a plan of action for the establishment of the four-way linking platform; and (3) the monitoring of follow-up activities conducted by national stakeholders and provision of assistance for the establishment of a national multisectoral, integrated risk assessment mechanism for influenza, if requested by the country.

Implementation at the national level: pilot countries

This framework is to be tested in three pilot countries. Joint WHO/FAO/OIE review missions took place in the first two pilot countries – Egypt and Viet Nam – in December 2010 and June 2011, respectively. Subsequently, the two national workshops were conducted in September 2011 and February 2012. These scenario-based workshops addressed principles of joint risk assessment and risk communication, and showed the need for joint outbreak investigations and joint risk assessment; they generated discussions on required mechanisms for joint reporting and assessment of outbreak findings, for policy and decision-makers. Egypt held the first four-way linking meeting with the designated focal points of the four sectors, in February 2012. It is hoped that countries will develop formal agreements between public and animal health sectors to improve cooperation and data sharing. The third pilot country is Bangladesh; the review mission is planned in July 2012 and the workshop, in October 2012. Discussions are ongoing for implementation of this framework in other countries that face endemic H5N1 HPAI. Interest has already been expressed by India and Indonesia. Suggestions have also been made to expand this initiative to other zoonoses.

repeatedly come into contact over time with swine and poultry species, new viruses could emerge or be transmitted into the human population. The aim is to overlay various agro-ecological and virological data to gain a deeper understanding of what drives the emergence of new, potentially pandemic influenza viruses.

As previously mentioned, greater interaction between epidemiology, surveillance and communications is developing at the regional and country level, including interagency coordination. Also, while further study and integration of surveillance and socio-economic disciplines is needed, coupling cross-border risk assessments with socio-economic market chain studies has improved understanding of trade, risk factors and regulatory compliance. As a result, all efforts to find locally relevant models and approaches to disease prevention and response are better informed. A recent example of applying this experience to other challenges besides HPAI is an integrated regional public health-animal health surveillance

BOX 4.5

The EMPRES-i genetic module: a new tool to link epidemiological and genetic influenza information

Combining surveillance, genetic characterization and geomapping for animal influenza viruses can contribute to a better understanding of the epidemiology of influenza as well as virus evolution. Adding information such as agro-ecological farming system characteristics, can also 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, EMPRES-i, therefore, provides a unique tool to improve knowledge in disease epidemiology and ecology. More broadly, this tool can constitute an influenza gene observatory and has already been proposed to support risk assessment of human-animal influenza threats. Scientists in the human and animal health sectors have confirmed interest in such a tool and OFFLU endorsed it in 2011.

History and progress

A web service was developed in 2010 between EMPRES-i and OpenFluDB that enabled these databases to compare their respective information, such as host species or geographical location. In 2011, an algorithm was developed as the interface between EMPRES-i outbreak data and influenza virus sequences present in OpenFluDB. This interface ranks all suitable isolates against all outbreaks according to the best combination of three criteria (geolocation, host species, time of sampling/event) and provides an automatic score from 0 to 100 percent indicating the confidence of each most possible proposed linkage. When possible, the manual validation of the linkage between sequences and outbreaks is carried out on this interface.

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programme in Southeast Asia. This programme addresses important zoonotic diseases for which flying foxes (bats; *Chiroptera spp.*) are reservoirs that can infect people either by direct contact or through livestock species such as pigs.

Participatory approaches, such as PDSR in Indonesia, for example, have demonstrated that contact through active surveillance may have stimulated greater passive reporting due to the establishment of relationships with communities, especially when strong links between livestock holders and the animal health service are formed (see Chapter 4 for more information on PDSR in Indonesia). Similar examples of surveillance at the community level include CAHO in Egypt and the SMS gateway in Viet Nam and Bangladesh. These surveillance systems have improved the quality and numbers of disease information reported in HPAI endemic countries. However, factors influencing reporting include turnover of local veterinary staff in developing countries and HPAI fatigue, compounded by unsound culling policies and insufficient compensation.

Development of applications

The genetic module benefits from existing tools 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, the sequence similarities maps (SSM) enable identification of relative genetic distances for a high number of viruses which is then used to study virus evolution and clusters, in combination with epidemiological information (e.g. date, species, location). FAO and SIB have been working on these possible applications of the tool including spatiotemporal mapping of virus clades and clusters (that can be overlaid by other layers such as animal densities maps); screening for distribution of viruses (according to geographical location, host, time) with molecular markers of interest; identification of potential drivers of virus evolution and the occurrence of reassortment events and knowledge gap analysis of virus sequences.

Expansion and Future

FAO is currently applying this module to analyse data from FAO and national surveillance projects in various countries. It will make this tool available in 2012 for scientists who wish to use it or propose further developments of it. The scientists will also be invited to propose linkages between known sequences and outbreaks. The ability to link to other influenza databases such as GenBank/Influenza Virus Research, Global Initiative on Sharing Avian Influenza Data (GISAID)/EPIFLU, and Influenza Research Database (IRD) are also being explored. In parallel, efforts have been initiated by FAO at the country level, so that the linkage between sequences and outbreaks is preserved. Development of this module for other diseases is being considered and has been initiated for FMD.

Other lessons include the fact that global surveillance is improved only if networks are active and strong at the national and regional levels. For any programme to be successful, incentives for disease reporting need to be identified and discussed with all stakeholders in the different livestock (mammalian and avian) value chains from the beginning.

FAO's HPAI response response efforts in epidemiology and surveillance have led to increased coordination, awareness and timely response to disease trends, potential disease emergencies and new HPAI/other disease events. However, much work remains to address ongoing influenza threats as well as other high-impact diseases.

The continued need for increasing emphasis on risk-based and systems-based approaches for disease detection, prevention and control will lead to cross-sectoral benefits. To prevent disease events and to be better prepared in places where they are most likely to arise, future efforts will rely on predictive risk profiling and modelling for endemic, emerging or re-emerging infectious diseases. Risk-based, cost-effective surveillance guidelines are needed at a regional level with implementation mechanisms outlined at the national level, requiring national investments for the public good.

SURVEILLANCE TRAINING

Staff turnover and ongoing HPAI and other disease threats make continued training in surveillance very important.

To date, FAO's activities have included significant efforts to develop integrated surveillance training of field epidemiologists and laboratory personnel in order to improve the response and coordination to disease outbreaks at country and regional levels, such as FETPV. A hands-on training and mentoring approach, FETPV builds the capacity of the individual veterinarian as well as the institution. It promotes the establishment of formal and informal networks of veterinary epidemiologists who apply their skills in field epidemiology. Through systematic training according to identified national needs, FETPV helps develop national and regional strategies for developing capacity in veterinary epidemiology, particularly human resources.

As part of the FETPV programme, FAO developed a human-wildlife-environment interface module entitled, Wildlife Investigation in Livestock Disease and Public Health (WILD) which has been delivered to more than 30 countries in Africa, and 14 countries in Southeast and South Asia, including the specific national FETPV programmes in Thailand and China. Further courses are planned for Thailand, Bangladesh and Ghana in mid-2012.

Additional epidemiological training and technical assistance in data collection, analyses and management have occurred in Africa and Asia. Two examples include a training workshop held in July 2011 in the United Republic of Tanzania on risk analysis and mapping in reference to HPAI and other TADs, and a HPAI simulation exercise trainers' training session in Togo in August 2011. Training has enabled local staff to have transferable skills in surveillance. An example includes enabling staff in Southeast Asia to be able to respond to the increasing challenge of hvPRRS in the region. Local staff from countries in Asia have been trained to conduct surveillance for H1N1 influenza in pigs. H1N1 surveillance reporting has demonstrated the level of interactions between swine and poultry and a broader approach is expanding to include contact populations of bats and humans. Further capacity development for local veterinarians is needed to sustain this effort along with the benefits derived from such cross-sectoral exchanges with wildlife and public health entities. Meetings with the FAO, OIE, WHO Tripartite[49] and national partners have promoted joint and coordinated surveillance pilot studies for rabies, ERV, H1N1 and HPAI.

APPLYING SURVEILLANCE INFORMATION FOR GLOBAL EARLY WARNING

While risk-based, targeted surveillance has brought better information to light regarding influenza A viruses, a next step in successful prevention, detection and response is the use of surveillance results to better understand disease and inform actions and mitigations. This step requires collection, analysis and real-time distribution of information gained through all forms of surveillance around the world so that countries and entities can then apply the

[49] http://www.fao.org/docrep/012/ak736e/ak736e00.pdf

knowledge gleaned. The joint FAO/OIE/WHO GLEWS[50] has been providing this service since 2004. It is currently at the forefront of capturing disease events to provide a global disease situation baseline, expanding types of data gathered, increasing the collaborations for data sharing, strengthening countries' disease information management, improving the quality of disease information reporting, and providing enhanced disease intelligence analyses capability and early warning information to countries. For examples, please see the GLEWS website: http://www.glews.net/

EMPRES-i is a web-based platform conceived within GLEWS to collect reliable information on animal disease outbreaks and surveillance activities of select priority diseases.[51] Combining surveillance, genetic characterization and geomapping for animal influenza viruses can contribute to a better understanding of the epidemiology of influenza as well as virus evolution. Integration of viral characteristics into an animal disease database (EMPRES-i genetic module) provides a unique tool to improve knowledge in disease epidemiology and ecology. In 2011, an algorithm was developed as the interface between EMPRES-i outbreak data and influenza virus sequences present in OpenFluDB, a specialized human and animal influenza database developed by the Swiss Institute of Bioinformatics (SIB),[52] that enabled both databases to integrate respective information for the benefit of the user, such as host species, geographical location and genetic sequences.

WILDLIFE SURVEILLANCE

Surveillance for zoonotic diseases such as HPAI, severe acute respiratory syndrome (SARS) and ERV in wildlife populations is an important way to assess specific health risks at the human-animal-ecosystem interface.

FAO wildlife surveillance and telemetry information has contributed significantly to the global knowledge base that exists about the role of wild birds in H5N1 HPAI. The data collected by FAO has also been utilized to inform and advance the science related to global avian influenza risk modelling, and to define additional important wetland and migratory waterfowl conservation needs. Overall, because of training and coordination, surveillance is increasingly conducted using a One Health approach to address diseases transmitted among people, livestock and wildlife (see Box 4.6).

ENHANCING COMMUNICATION AT THE COMMUNITY LEVEL

With the understanding that awareness-raising activities by themselves were not leading to changes in behaviour and improved farming biosecurity practices, FAO has been emphasizing the need to shift away from didactic, top-down communication towards processes and tools that are driven by deeper community participation and voluntarism.

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[50] FAO, OIE, and WHO have each developed systems that collect, analyse and respond to information on outbreaks from a variety of sources, including unofficial media reports and informal networks. The joint FAO/WHO/OIE GLEWS for major animal diseases, including zoonoses, was created in 2006 to act as a joint system that builds on the added value of combining and coordinating the early warning capacities of OIE, FAO and WHO for the benefit of the international community.

[51] EMPRES-i is a web-based application that has been designed to support veterinary services and organizations by facilitating the collation, analysis of and access to animal disease information. More information can be found at http://empres-i.fao.org

[52] More information is available at http://www.isb-sib.ch

BOX 4.6

Increasing wildlife knowledge at the animal-human-ecosystem interface

Approximately sixty percent of emerging infectious diseases of humans are zoonotic. Of these, 70 percent originate in wildlife. These pathogens and diseases include HIV/AIDs, Nipah, Hendra and WNV, as well as ERV, rabies, SARS and monkey pox. It is clear that preventing further transmission of emerging infectious diseases among species and minimizing impacts if they do jump species relies on collaboration and integration of multiple disciplines and partners including ministries of agriculture, health and forestry and environment. Working with ministries of forestry and agriculture, FAO's Wildlife Health and Ecology Unit is conducting wildlife disease surveillance in a variety of species including waterfowl, waders, shorebirds, flying foxes, insectivorous bats, wild boar, gazelle and buffalo in more than forty countries. Additionally, FAO has marked more than 650 wild animals in more than 25 countries including buffalo, flying foxes, migratory waterfowl and wild boar to better understand their habitat use, migration patterns, and their interactions with livestock, people and other wildlife species. The information gleaned from these efforts contributed to disease ecology studies that determine the role of wildlife in outbreak events, and also provides valuable information to resource managers to enable them to protect species and sensitive habitats. Below are just a few examples of specific projects in a One Health approach.

The Role of Bats in Emerging Zoonoses

Bats (order *Chiroptera*) are the second most diverse mammal group in the world. Despite their importance in maintaining the health of plants and animals via the ecosystem services they provide, bats are disliked in many regions of the world due to cultural myths and lack of knowledge. The emergence of the novel Nipah Virus, between 1998 and 1999 in Malaysia resulted in over one million pigs culled, 257 human cases reported of which 105 were fatal, and numerous surviving persons who continue to suffer neurologic signs (more information available at available at http://www.ncbi.nlm.nih.gov/pubmed/10823779). Since 1999, additional outbreaks have occurred in Malaysia, Singapore, Bangladesh and India affecting both pigs and humans. The natural reservoir host for this virus has been identified as fruit bats from the genus *Pteropus*. In Bangladesh, the virus made the jump directly from bats to humans, while outbreaks in Malaysia were caused by virus transmission from bats to pigs, and then from pigs to people. With the variety of transmission pathways, Nipah virus is one of the most concerning emerging diseases in recent times.

Managing zoonotic diseases for which bats are natural reservoirs requires multidisciplinary collaboration. Ministries of health, agriculture, forestry and the environment must work together to ensure that human, livestock, wildlife and ecosystem health are taken into account. In order to address these multidisciplinary concerns associated with management of bats, FAO published a manual in November

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2011 entitled *Investigating the role of bats in emerging zoonoses: balancing ecology, conservation and public health interest* (available at http://www.fao.org/docrep/014/i2407e/i2407e00.pdf). This manual explores bat ecology and the role that these mammals play in emerging infectious diseases while highlighting the important role they play in maintaining ecosystems that support human, plant and animal life. The manual targets epidemiologists, natural resource professionals, and veterinarians, among others, who interact with bats.

For more on the role of bats in emerging zoonoses see http://www.fao.org/docrep/015/i2811e/i2811e.pdf

Bats-Pigs-People: One Health surveillance in Thailand, Viet Nam and the Philippines

This regional FAO approach to understanding disease dynamics among bats, livestock and people was launched in late 2011 in Thailand, Viet Nam and the Philippines. The project builds upon the successful One Health collaboration implemented in the Philippines as a response to the detection of ERV in domestic swine. In the Philippines, the authorities collaborated and implemented surveillance in pigs, bats and people. In the new project, funded by the Australian Department of Agriculture, Fisheries and Forestry (DAFF), surveillance and radio-marking on flying foxes is continuing, with the aim to characterize better the interface between bat habitat use and movements, livestock farms and large densities of people. Development, deforestation, urban encroachment and expansion of farming are also contributing to decreased habitat for wildlife, including bats, which is not only a conservation issue, but leads to higher contact rates between bats, livestock and people. As the diseases of concern include rabies and other lyssaviruses, Hendra and Nipah viruses, Japanese encephalitis and other flaviviruses, Ebola viruses, SARS coronavirus, Menagle virus and Melaka virus, it is important to consider where risk may exist for direct bat to human transmission, or indirect human infection from bats to pigs to people. Furthermore, it has been recognized from the Philippine experience with ERV, that even if viruses do not cause disease in livestock, they can have significant implications on trade and the perceived risk to the public. For these reasons, a One Health approach that protects the interests of livestock producers, conservationists and public health is required.


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As of 5 May 2012, ten flying foxes (*Pteropus lylei*) have been marked in Thailand with samples collected for disease analyses.

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Mongolian gazelle – cattle interface and FMD

The pathways for entry of FMD virus into Mongolia and then subsequent exposure of susceptible animals can occur through movements of fomites (vehicles and goods), livestock or wildlife. Of these, wildlife and, specifically, Mongolian gazelle, has been implicated in the spread of FMD throughout much of the eastern three Aimags during the 2010 epidemic affecting pastoralist cattle herds. Reactive measures included large-scale culling, blockading of underpasses along a railway, and hazing herds to reverse their direction of travel. However, there has been no scientific study to date linking gazelles as the cause of FMD outbreaks and some supporting evidence exists demonstrating that gazelle may be passive recipients of the disease once an outbreak is already occurring. The project currently underway with the Mongolian authorities and several other partners involves surveillance in both cattle and gazelle, analysing movements of gazelle and cattle using radio-telemetry, and evaluating the interface between pastoralist herds and gazelle. In addition, a retrospective analysis is being conducted to determine whether there are spatial or temporal relationships between 2010 FMD outbreak foci in domestic livestock in Mongolia with livestock density, preferred gazelle habitat, and gazelle location as determined from satellite telemetry data. In conjunction with these activities, there is a significant capacity-development dimension to this project. That will prepare national authorities to prevent future FMD outbreaks and to mitigate the impact of future FMD events on livestock and Mongolian gazelle, thereby supporting livelihoods, food security, and the conservation of this near-threatened species.

Wildlife farming and bushmeat consumption:
One Health implications for resource management, livestock and public health

The use of wildlife and its products, in particular wild meat, traditionally contributes to food and nutrition security, provides protein intake and generates revenues for the livelihoods of communities. It is deeply rooted in their cultures. However, this subsistence activity is rapidly moving towards large-scale business enterprises. Such an evolution in consumption and more systematic trading is driven by population growth, urbanization and globalization. This increase in the exploitation of the resource and the development of informal trade practices, often against the interests of local people, raises new health, environmental and socio-economic issues and can undermine the livelihoods of local communities. In order to acquire a deeper understand-

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FAO has responded quickly to lessons learned about the need for **greater community engagement**. Participatory communication interventions have been developed and are being carried out in Bangladesh, Indonesia and Egypt. These activities range from the training of village animal health workers as community level communicators, to local forums enabling communities to increase their capacity for decision-making to combat HPAI and other diseases, to devising grassroots sustainable biosecurity measures for resource-poor settings through the use of participatory communication methodologies.

ing of the new challenges related to wild meat use, social, ecological, and economic viewpoints should simultaneously be taken into consideration. Approaches aimed at addressing this issue require an intersectoral and multidisciplinary One Health effort to provide concrete strategies and to reduce undesirable economic, social and environmental impacts. To take up these new challenges and to design tomorrow's wild meat-use policies, international organizations such as FAO have to define policies and options to help public policy-makers choose their priorities from now on, adapted to their own situation. Through multiple partnerships including the Scientific Task Force on Wildlife and Ecosystem Health, and the Convention on Biological Diversity's Liaison Group Meeting on Bushmeat, FAO is making contributions that help address this important topic, which has implications for food security, international trade, disease transmission and conservation. FAO's Wildlife Health and Ecology Unit : 1) supported the 2010 Conference of Forests Side Event, Hunting Trade and Management of Wildlife in Tropical Forests, by making a presentation entitled Wildlife Farming and Bushmeat Consumption: One Health Implications for Resource Management, Livestock and Public Health; 2) encouraged capacity development related to wild meat and bushmeat issues in the Congo Basin and West Africa; 3) supported the FAO Forestry Global Environment Facility (GEF) project; and 4) sponsored an interdepartmental workshop on 26 October 2011 entitled, Wild meat, Bushmeat, Livelihoods and Sustainability: Implications for Food Security, Zoonoses, Food Safety and Biodiversity Conservation which aimed to enable sharing of information, but, more importantly, started the preparation of a Draft Position Paper on wild meat and bushmeat including perspectives across FAO departments. For more information see http://www.fao.org/ag/againfo/programmes/en/empres/bushmeat_meeting_2011.html.

Disease investigation on the interactions between domestic cattle and wild bovids in Botswana

Many diseases can be shared and transmitted between cattle and African buffaloes. Evaluating the animal health status and understanding the transfer and dissemination of pathogens at this interface is a high priority for veterinarians and wildlife managers in the Transfrontier Conservation Areas (TFCA). Diseases targeted included bovine tuberculosis, brucellosis, RVF, theileriosis , FMD and lumpy skin disease. This study provided the first baseline data on the circulation of these infectious diseases in two of the most representative areas for wildlife within the Botswanan part of the Kavango Zambezi TFCA.

FAO has also developed and successfully field-tested dialogue-based tools and innovative processes to engage non-technical audiences in a deeper understanding of and involvement with transmission, prevention and control of not just HPAI but, increasingly, other zoonotic endemic, emerging and re-emerging infectious disease threats. The method, which works by stimulating and harnessing curiosity, and finding socio-culturally acceptable descriptions of technical topics, has yielded significant changes in individuals in terms of their understanding and interest about biosecurity, and their ability to act upon the knowledge acquired.

FAO has also been active in providing technical assistance and in building capacities for communication planning with an emphasis on strengthening the technical capabilities and competencies of ministries of agriculture or livestock in a number of at-risk countries in outbreak, risk and behaviour-change communication. It has taken a multidisciplinary approach, collaborating closely with epidemiology, biosecurity and socio-economics experts. Regional multidisciplinary workshops in communication planning and skill-building for HPAI prevention and control have been held for North Africa, West and Central Africa, East Africa and Central Asia, involving over 40 countries. One such example is the April 2011 regional workshop involving ministries of agriculture and health, journalists and other stakeholders on HPAI preparedness held in Kenya (i) to review the current status of communication in the prevention and control of HPAI and other TADs in the region, particularly with regard to communication strategies in place; (ii) to consider the role of the media in the fight against HPAI and other TADs including zoonoses as bridges between experts and the general public; and (iii) to strengthen intersectoral collaboration on animal and public health communication.

SOCIO-ECONOMICS, STAKEHOLDERS AND DISEASE MANAGEMENT

HPAI highlighted the importance of understanding stakeholder behaviour and how it can affect disease spread and also management and control. In short, socio-economics must be an integrated part of any effort to achieve effective disease control that takes into account peoples' incentives and disincentives for compliance. For success, required economic data must be integrated, accurate and up-to-date.

Understanding the social and economic context of people provides an entry point to improved disease control and management. Markets, producer and smallholder sectors, incentives, partnerships across productions and food chains and between public and private sectors, communities, and factors at the local level, all play important roles (see Box 4.7). HPAI elucidated the importance of going beyond scientific and veterinary disease basics to include understanding of the human, livelihood, and socio-economic factors affecting disease dynamics and control, beginning at the local level. Specific to HPAI lessons learned, there is now a greater appreciation of the importance of poultry owners and value chain stakeholders when addressing disease surveillance, reporting, containment and control. As a result, there is enhanced collaboration with the private sector, searching for options for demand-driven HPAI control and considering compliance incentives when developing HPAI control programmes. Also, capacity-building is ongoing to better integrate socio-economics into field epidemiology (i.e. social networks and disease dynamics).

In 2011, specific activities conducted in Asia to better understand the poultry trading routes and value chains have directed the formulation and re-formulation of control and surveillance guidelines with respect to the designation of high-risk districts and high-risk nodules along the poultry market chain for active surveillance sites. In 2011, in Africa, mapping of national trade flows in poultry and poultry products through value chains and trade flow analysis in Rwanda, Kenya, Uganda and the United Republic of Tanzania was performed. Participatory interactions with stakeholders throughout the chains will lead to solutions relevant to their interests. It will also increase the potential of their engagement in the disease control programme and ownership of the outcomes.

BOX 4.7

**Redefining engagement with stakeholders:
PPR and the livelihood-centred animal health protection approaches**

One of the many lessons from HPAI has been the need to engage all stakeholders from the onset in disease management and control. ECTAD's socio-economic unit has been helping veterinary services understand and identify the different actors and value chains within which disease occurs. This information is now helping to develop and implement a livelihood-centred animal health protection approach for diseases such as PPR.

A livelihood-centred animal health protection approach is premised on understanding the livelihoods of livestock producers better, and building upon their requirements for a more effective and efficient animal health care. This goal involves reducing the animal disease burden at household level; increasing production, and thereby ensuring investment into animal health; engaging the community to allow for appropriate strategies and animal health delivery mechanisms; and soliciting national and international support to provide policy support and appropriate initial investments in technology development.

Initial socio-economic work is concentrating on improving the understanding of the livelihoods, demands and decisions made by livestock producers, on the economics and relationships they have across the value chains, and on identifying gaps in technologies within this context. This work will allow for an improved engagement of all stakeholders as it will build upon identified win-win situations for all involved.

Work continues on understanding decision-making of livestock keepers and other stakeholders, to enhance compliance through creating better incentives and limiting disincentives. It is also acknowledged that the disease-management programmes need to know how best to reduce disease risk while not interfering with trade or having control programmes drive price differentials in the products of affected sectors.

Examples of activities related to this work were conducted in 2011 in East Africa, where FAO supported development of a draft regional livestock policy for the region in order to contribute to the harmonization of livestock policies and plans in the EAC members (Burundi, Kenya, Rwanda, the United Republic of Tanzania and Uganda). The harmonized policies are intended to provide a framework for improved livestock sector development through better coordination and management of HPAI and other TADs, in response to regional market demands. Efforts such as these are important because unenforceable legislation that attempts to contradict economically successful and well-established trading practices is counterproductive. Most communities and stakeholders will continue to trade in a manner that precludes health inspection, good biosecurity or other assurances of disease-free status.

Similar observations can be made about socio-economics, marketing chains and drivers with regard to lessons learned on vaccination policy/implementation and biosecurity issues.

MANAGING VACCINATION SCHEMES

Vaccination is one of several tools in a pallet of disease control methods which includes surveillance, market and movement control, humane culling, enhanced biosecurity and vaccination, all of which should be discussed among all stakeholders when developing a targeted, comprehensive strategy that allows countries and regions the flexibility to adapt to their needs over time.

Initial triggers for vaccination included industry demand, economic loss and the protection of public health. Reactive decisions were made to meet immediate needs and there were limited technical resources and information to develop an exit policy. There was limited public sector experience with animal mass vaccination against avian influenza and in some countries industry demand for vaccine programmes drove programmes that were far from comprehensive in nature. Vaccination decisions should also reflect differences and incentives needed in the commercial and backyard poultry sectors. Both of these sectors require greater interaction between industry, stakeholders and government disease managers and politicians.

From 2005, numbers of reported human cases in China, Viet Nam and Indonesia have been declining. This result can be attributed partially to poultry vaccination. Currently, a targeted approach is being used to control HPAI in Indonesia and Viet Nam and an HPAI policy is evolving from control to elimination in China. A phased approach for an exit strategy is now being planned in Vietnam and China. Vaccination continues to be a challenge in Egypt (see Chapter 3).

Vaccines are now being assessed at least twice annually as recommended in Asia and OFFLU, and national laboratories have collaborated to play a key role in conducting antigenic and molecular analysis of field isolates necessary to adjust vaccine strains. This collaboration is especially important as, in the past few years, a newer variant of the H5N1 virus, referred to as clade 2.3.2.1, has emerged and expanded its geographic range from Southeast Asia to Eastern Europe, East Asia, and South Asia. Some variants of clade 2.3.2.1 are different enough from other H5N1 HPAI clades so that available poultry vaccines are ineffective in some countries.

Scientific and technical vaccine and vaccination-related specific lessons include:

- Inactivated vaccines remain the most effective method of immunizing poultry against H5N1 and this may likely be the best option for the next decade.
- Regular semi-annual vaccination quality checks should be conducted to assure that vaccine master seed strain matches the field strains. In addition, cross-sectional studies are needed as part of a vaccination programme in order to measure real vaccine coverage in the field.
- Knowledge of agent-host (i.e. virus-birds) interactions has increased though many questions remain.
- Specifically for domestic ducks, further field trials may be required for improved vaccination schedules, to assess more recent experimental challenge results for optimal efficacy at 7 and 21 days.

ENHANCING BIOSECURITY PRACTICES

Successful biosecurity programmes require a detailed knowledge of the production systems and practices and early engagement of producers in developing appropriate solutions through a participatory process.

Biosecurity has been recognized as the main tool for the prevention and control of HPAI and other poultry diseases, especially in countries where HPAI vaccination has proven to be non-effective. While over the last few years there has not been any significant improvement regarding awareness, knowledge or implementation of biosecurity measures among back-yard poultry holders and duck producers (mainly due to lack of incentives), there has been improvement in the understanding of biosecurity in the role of HPAI and the challenges and opportunities of biosecurity issues with the private sector. In HPAI-infected countries, there is a growing interest, by both the poultry producers and veterinary services, in biosecurity as a tool for the prevention and control of multiple diseases.

Currently, the HPAI-infected countries in the Asian region and Egypt are at different stages of development and implementation of biosecurity programmes (see more specific information in Chapter 4). Adaptation of standardized biosecurity approaches has advanced and a second generation of more realistic and appropriate measures and approaches are now emerging. For example, research is currently underway in Indonesia to identify the most cost-effective biosecurity practices for layer farmers. In Vietnam, several pilot approaches to biosecurity improvements have also been completed. The sustainability of training programmes is largely in the hands of the private sector, but, in most countries, the support of veterinary services will be required. Continuation of biosecurity training programmes in HPAI-infected countries is needed for better knowledge and awareness of producers and other partners. It is of note that a more holistic approach to disease prevention with regard to biosecurity measures would be to move away from a specific single disease initiative and, instead, focus on multi-disease control programmes, good production practices and overall herd/flock/animal health management. This approach would better reflect real world disease pressure conditions, provide more efficiencies, be more cost-effective, improve farm profitability, increase incentives and gain increased application by livestock holders.

Improved collaborations and partnerships between the public and private sectors are essential for effective implementation of biosecurity programmes in poultry production and along the entire marketing chain.

An excellent example can be seen in Bangladesh,[53] where the country has developed and approved national biosecurity guidelines for the commercial sector, and has developed biosecurity SOP's and training programmes. Additionally, government veterinarians have been trained as biosecurity auditors to assess proper plan implementation. The programme has mechanisms of public and private partnerships and is fully supported by the industry and the Department of Livestock (DLS). Only minor adjustments would be required for the establishment of similar biosecurity programmes to support other livestock industries and the model adapted in other countries.

PARTNERSHIPS

Coordination and partnerships at the local, national, regional and global levels have been essential in the eight-year HPAI effort in all countries. Coordination and a concerted, sustained effort are vital in endemic hotspot areas. FAO has played a central role in forging

[53] Available at http://www.fao.org/asiapacific/bangladesh/en/

and coordinating partnerships among a number of players and stakeholders involved in the control of HPAI and other high-impact emerging and re-emerging infectious diseases. These have included partnerships with national governments, NGOs, donors, national and international research institutes, regional organizations and other international developmental and technical agencies.

Global and regional partnership efforts to address the problem of H5N1 HPAI have clearly yielded significant results. The understanding that a pathogen that predominantly causes losses in livestock can cross species barriers to affect humans and result in epidemics and pandemics has spurred politicians and decision-makers to invest in the challenge of preventing and countering emerging infectious diseases. Much work remains to further address ongoing influenza threats as well as other zoonotics and TADs. The complexity of the drivers of these zoonotic infectious diseases that have such widespread impact has stimulated a One Health movement that promotes multidisciplinary and multisectoral approaches to addressing the complexity of the problem.

TOWARDS A ONE HEALTH APPROACH

The framework to manage diseases effectively at the human-animal-ecosystem interface is known as the One Health approach. One Health addresses threats and reduces risks of emerging and re-emerging infectious disease through a collaborative, international, cross-sectoral, multidisciplinary approach. To date, the One Health approach has been used to address infectious diseases, but this framework can be used across disciplines to address a wider range of issues across the three health domains. More specifically, One Health acknowledges the animal-human-ecosystem interface, and places disease dynamics into the broader context of agriculture and socio-economic development and environmental sustainability.

FAO developed a strategic AP entitled, Sustainable animal health and contained animal-related human health risks – in support of the emerging One-Health agenda.[54] This plan has taken the lessons learned from the avian influenza response since 2006 and applies this knowledge in approaches to the control of other emerging infectious diseases and global TADs. The AP promotes a proactive approach to disease risk management. The actions recommended are risk-based and tailored to the local context engaging the people involved through participatory processes. All actions of the plan aim at sustainability and ownership by countries and regions. They range from immediate to long-term actions with a developmental perspective (see Box 4.8).

FAO's Animal Production and Health Division (AGA) has been leading One Health discussions within FAO as well as at the global level with international partners (see Box 4.9). The tripartite mechanism under which FAO, OIE and WHO share plans and identify opportunities for collaboration, is leading to a deeper appreciation of shared perspectives, issues and goals. One collaboration example is the FAO/OIE OFFLU, a global disease specialized network that works at the human-animal interface. In February and September 2011, OFFLU contributed to two Vaccine Composition Meetings held by WHO in Geneva to help determine strains to be included in human vaccines for the upcoming influenza season (see Box 4.10).

[54] See Chapter 6 of the Fourth Report January–December 2010 Global Programme for the Prevention and Control of Highly Pathogenic Avian Influenza for further history and background (available at http://www.fao.org/docrep/014/i2252e/i2252e00.pdf).

BOX 4.8

FAO's One Health strategic action plan: promoting One Health at the animal production and health division

During 2010, FAO worked on a corporate strategy and an AP for the period 2011 to 2015, setting out the priorities and the organization's contribution to the One Health framework. Since the AP's approval in March 2011, efforts have been underway to implement it at the global, regional, national and local levels. Overall, the AP is creating a more robust global animal health system that effectively manages major animal health risks, paying particular attention to the animal-human-ecosystem interface, and placing disease dynamics into the broader context of agriculture and socio-economic development and environmental sustainability.

The AP emphasizes the following six broad priority actions for the first phase (2011–2013). Identification of these priority areas takes into account the immediate capacity requirements and needs for better management of animal associated health threats at global, regional and country levels. As the AP progresses and more funding becomes available, other services and products will be undertaken to complement the ongoing activities in order to achieve the goals and the objectives of the AP by 2015.

The FAO One Health AP priority areas

- continue the campaign against H5N1 HPAI with greater emphasis on a long-term approach to disease control in endemic countries;
- develop the progressive control pathway approach for priority diseases;
- strengthen the international capacity for emergency response support;
- develop an upstream approach to disease prevention and control through better understanding disease drivers and risk factors for disease emergence, persistence and spread;
- support disease intelligence and global early warning; and
- provide support to disease impact and socio-economic analyses.

In support of the One Health approach, advocacy initiatives at the country and regional levels have been developed to provide a wider focus on infectious diseases of high impact to facilitate information sharing and improved evidence-based decision-making along with a more strategic and effective long-term prevention and response capacity for animal, human and zoonotic pathogens.

For example, in addition to providing country personnel with training in an holistic approach to wildlife and livestock epidemiology and surveillance methods, surveillance data collection of animal diseases is being enhanced and integrated with environmental and food safety data in pilot countries. This data will be utilized to provide more comprehensive data for risk analysis. It will allow improved risk modelling (based on more layers of data) that will support early warning on animal diseases at regional levels for the international community. It will also enable improved predictive and response information for countries.

BOX 4.9

2011 FAO and global One Health efforts

In May 2011, FAO's Agriculture and Consumer Protection Department hosted an inter-departmental FAO Corporate One Health Workshop at FAO headquarters to bring together experts and leaders from across FAO's diverse disciplines and departments. The aim of the Workshop was to identify areas for improved collaboration within FAO and to explore a possible organization-wide One Health strategy. The two-day Workshop was attended by 44 people from more than 20 different backgrounds within FAO as well as observers from OIE and WHO. Throughout the Workshop, participants were invited to reflect on ways One Health is implemented in their discipline and to consider how it could be improved. Defining the FAO corporate One Health strategy, encouraging close collaboration between organizations, and supporting interdisciplinary thinking, were all highlighted as major areas of synergy throughout FAO.

Since that Workshop in 2011, significant changes, both internal and external, have taken place within FAO which strongly signal that the time is right to reconvene to pursue the One Health approach at an international organizational level. Leading by example would entail further reform and mainstreaming of the One Health approach at FAO. Some highlights demonstrating the momentum the One Health approach has gained externally, and with FAO partners, since the Workshop include, but are not limited to: 1) the High Level Technical Meeting to Address Health Risks at the Human-Animal-Ecosystems Interfaces 15-17 November 2011 in Mexico City (available at http://www.hltm.org/index.php); 2) the USAID-funded RESPOND project setting One Health networks in Africa and Asia between veterinary and public health faculties; 3) the Global Risk Forum One Health Summit 2012: One Health - One Planet - One Future Risks and Opportunities 19-22 February 2012 in Davos, Switzerland (available at http://www.grforum.org/pages_new.php/one-health/1013/1/938/); and 4) the development of courses and degrees in One Health at a number of universities.

Through workshops and national consultations, countries are assisted in formulating their own One Health frameworks. Collaborative working relationships to provide regular communication and coordination between various ministries of agriculture, public health, environment and forestry are a more routine occurrence. For example, FAO facilitated the One Health consultation to establish a One Health framework and roadmap in Bangladesh. This led to the region's first national One Health strategy. In Asia, FAO worked collaboratively with UNICEF, AED, World Health Organization–South-East Asia Regional Office (WHO-SEARO) and others to develop *One Health: seeing around corners*,[55] the first One Health-driven communication strategy framework. Based on this framework, several countries, including Bangladesh and Viet Nam, are developing country-specific One Health communication strategies relevant to HPAI and a range of other diseases.

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[55] Available at http://www.fao.org/docrep/014/al911e/al911e00.pdf

Veterinary public health has seen increased emphasis in 2011 with country-level activities on rabies, zoonotic parasitic diseases, anthrax, food safety and antimicrobial resistance data gathering efforts, to name a few. For livestock, well-understood interventions can be applied in the context of the One Health approach and integrated control of zoonotic diseases provides an ideal platform for One Health at the community level. In addition to its commitment to global initiatives to develop and institutionalize the One Health agenda, FAO has been working actively at the country level to operationalize One Health through locally adapted approaches for improved surveillance, joint outbreak investigations, increased community awareness, establishment of policy platforms, effective delivery of control measures, joint simulation exercises and increased and synergetic intersectoral collaboration.

In many instances, zoonotic diseases have their roots in controllable disease in animals, especially in domesticated species. There are a number of endemic zoonotic diseases such as anthrax, brucellosis, tuberculosis and rabies for which successful control can only be achieved if the attitudes of communities are fully understood and taken into account in developing control policies and strategies. Brucellosis, bovine tuberculosis and rabies are diseases of increased concern as they emerge and re-emerge in many developing countries where control programmes are not adequately implemented and habits such as pasteurization of dairy products, proper handling of infected meat products and vaccinations are not commonly practised in rural communities. There are very significant benefits to human health, household food security and poverty alleviation from control and elimination of these diseases. FAO has been working in this direction by developing integrated control approaches with effective implementation at national and community levels (see Box 4.11). In many developing countries, especially rural areas, international interventions to reduce disease burden is hampered by inadequate technologies not adapted to the local prevailing production systems, agro-ecological conditions, reduced capacity of veterinary services and lack of coordination. Under a One Health approach, FAO is working to develop holistic community-based animal health packages for the management and control of animal and zoonotic disease constraints/risks. These are designed to alleviate poverty and to improve animal and human health, livestock opportunities for rural development and food security. These efforts are site-specific, developed in direct partnership with the livestock holders and keepers, farmers, farmers' associations, communities and local governments. These can be delivered through a variety of ways depending on the local context: livestock holder/keeper field schools, CAHWs and community Animal Health Clubs (AHCs).

The aim is to provide technical information and guidance and to foster interaction between the stakeholders of a specific livestock production chain in order for them to identify collectively options for sustainable development, and animal and zoonotic disease intervention strategies. Stakeholders' concerns, priorities and constraints are identified and discussed, including potential roles to eliminate constraints. FAO's AHCs and livestock holder/keeper field schools could take the dialogue, knowledge and AP resulting from the national diseases policy platform and apply it at the community level in a collaborative, locally customized and sustainable manner. AHCs provide basic training for teachers and school children on prevention and control of zoonotic disease, animal husbandry practices and general health education including nutrition, sanitation and environmental hygiene.

BOX 4.10

OFFLU laboratory network contribution to the WHO biannual consultation on the composition of influenza vaccines – One Health in action

Every six months, a global team of specialists reviews all human influenza virus activity and virus characterization. The review includes human seasonal influenza and zoonotic influenza, that is A(H5N1), A(H9N2), A(H1N1) or any other relevant subtype. The team also examines the status of development of new candidate vaccine viruses. This process is meant to provide guidance for national authorities and vaccine companies on the selection of candidate viruses for use in vaccine development. In January 2010, an agreement was signed between OFFLU and the WHO network, making official OFFLU's involvement in this consultation process for an initial period of three years.

Contributing Data for Analysis

Data sources of the OFFLU contribution include the OFFLU network laboratories (OIE/FAO Reference Centres in animal influenza, national laboratories of heavily infected countries) for molecular and antigenic data, animal health databases EMPRES-i (FAO) and World Animal Health Information Database (WAHID) (OIE) for epidemiological data; IVR-GenBank, SIB-OpenFludB, and GISAID-Epiflu for genetic sequence data. OFFLU experts (OIE/FAO Reference Centres and national veterinary laboratories) are contacted by the OFFLU secretariat for sharing of their published and unpublished data with OFFLU for the six-month period (February to September or September to February). Animal health genetic, antigenic data and epidemiological data are analysed and displayed by FAO. As with every WHO collaborating centre for influenza, OFFLU provides a report to WHO and the panel of available epidemiological and molecular data for animal influenza that require full attention. OFFLU also delivers a presentation giving an overview on the compiled and analysed data. Two OFFLU representatives participate in the consultation: an expert from an OIE/FAO Reference Centre (rotating attendance) and an OFFLU/FAO scientist.

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The information is imparted to school pupils and university students, along with training and mentoring by university staff and veterinary staff. The pupils and students then share the information with their friends, families and neighbours mobilizing them to take action to prevent diseases in their communities. AHCs have been well-utilized in addressing rabies outbreaks in several countries (see Box 4.12). Often the solutions to local animal and zoonotic disease can be found in small, practical things that stakeholders can do in husbandry, hygiene or animal management that will prevent or eliminate the pathogen. These community-based efforts provide education, extension and improved service delivery beyond specific disease issues. Local community education, active participation and leadership underpin a lasting capacity within the community to prevent and control diseases at the source.

Real World Results

In February 2011, OFFLU shared information related to 123 H5N1 HPAI viruses from Nepal, Viet Nam, Bulgaria, Romania, Myanmar and the Lao People's Democratic Republic, 76 of which were not yet publicly available while 47 were already publicly available. In September 2011, OFFLU shared new and previously unreported sequences from Bangladesh, Egypt, India, Indonesia, Israel, the Lao People's Democratic Republic, Myanmar and Viet Nam, representing clades 1, 2.1.3, 2.2, 2.2.1, 2.3.2, 2.3.4. The report included 245 H5 sequences (120 non-public and 12 public domain sequences from 2011; 113 non-public from 2009 to 2011). For H9, the OFFLU network contributed 20 pre-2011 sequences (the majority from 2009) and one 2011 sequence from Bangladesh. Among these viruses, one was selected by WHO for candidate vaccine virus preparation (clade 2.3.4.2 A/chicken/Bangladesh/11rs1984-30/2011). This virus was obtained through surveillance activities conducted by the veterinary services of Bangladesh with support from the FAO country office, and characterized by the OIE/FAO Reference Laboratory in Padova in April 2011. After the consultation, FAO and the Instituto Zooprofilattico Sperimentale delle Venezie (IZSVe) officially contacted the Government of Bangladesh to request the authorization to transfer the strain from IZSVe to the United States Centers for Disease Control and Prevention (CDC), which was provided.

The Future

More developments are foreseen in the field of testing by OIE/FAO Reference Centres of ferret antisera, enabling earlier and more systematic screening of antigenically variant viruses. The very satisfactory and increasing level of information-sharing from many countries and scientists is to be acknowledged. The outcomes of the consultancy process are published on the WHO web under: Antigenic and genetic characteristics of zoonotic influenza viruses and development of candidate vaccine viruses for pandemic preparedness (available at http://www.who.int/influenza/resources/documents/characteristics_virus_vaccines/en/).

At FAO, food security remains the priority, concurrent with protecting livelihoods, eliminating poverty, ensuring sustainable natural resource management, good nutrition and food safety, as well as good governance and policies in agriculture, forestry and fisheries practices. The One Health approach has clear advantages and can readily facilitate achieving these organizational mandates. While the etiology of One Health stems from infectious diseases, it is clear that the application of this approach can contribute to ensuring global food security, safety and improved nutrition.

BOX 4.11

Integrated control of zoonotic diseases provides an ideal platform for the One Health approach

In addition to its commitment to global initiatives to develop and institutionalize the One Health agenda, FAO has been working actively at the country level to operationalize One Health through locally adapted approaches for improved surveillance, joint outbreak investigations, increased community awareness, effective delivery of control measures, joint simulation exercises and increased and synergistic intersectoral collaboration. There are a number of endemic zoonotic diseases, such as anthrax, brucellosis and tuberculosis, for which successful control can only be achieved if multidisciplinary and integrated approaches are applied at all levels and the attitudes of communities are fully understood and taken into account when developing control policies and strategies. There are very significant benefits to human health, household food security and poverty alleviation from control and eradication of these diseases.

Collateral activities have been undertaken in response to anthrax outbreaks in Bangladesh, showing a good example of the One Health approach in action at the community level. There, the interaction and cooperation between local veterinary and public health services, as well as full involvement of anthropologists and social workers, facilitated the control of this zoonosis. Further examples of such collaboration and an integrated approach can be seen with brucellosis and tuberculosis control in developing countries. These global zoonoses present severe public health challenges and major economic burdens, particularly in developing countries with inadequate public health and veterinary services. Experience from FAO brucellosis control programme efforts in Tajikistan shows that vaccination of small ruminants, combined with public awareness, joint surveillance and close collaboration between veterinary and public health authorities, reduce the prevalence of brucellosis in animals and limit its transmission to humans. Both diseases are causing concern as emerging diseases in many countries where control programmes are not adequately implemented and pasteurization of dairy products is not a common practice in rural communities. In the case of both diseases, it was found that knowledge of the mode of infection or the importance of pasteurization significantly reduced the risk of infection, thus confirming the importance of public health education. It may be beneficial to consider promoting and facilitating small-scale or community pasteurization plants as part of the strategy to reduce the infection in humans, while a progressive control strategy was implemented to control each disease in susceptible animal populations.

Other challenges in controlling these diseases include the complex epidemiological pattern involving transmission between domestic animals and wildlife and the potential emergence at the animal-human-wildlife interface. A One Health approach is required for successful control, including the development of control strategies that are acceptable to communities and that take into account anthropological factors. FAO has been working in this direction by developing integrated control approaches with effective implementation both at national and community levels.

BOX 4.12

One Health applied: tackling rabies in communities

Rabies is a widespread, neglected and under-reported, acute and fatal zoonotic viral disease that infects domestic and wild animals and is transmissible to humans. Unvaccinated dogs can be infected with the rabies virus. Although rabies is 100 percent preventable, it is still found in over 150 countries worldwide, particularly in Africa, Asia, Latin America and the Middle East, and causes an estimated 55 000 human deaths every year. Over 95 percent of human rabies cases are caused through bites from infected dogs. In many countries, when prevention awareness is minimal, children, especially, become victims due to their frequent contact with dogs. Once rabies symptoms appear, it is almost certainly fatal.

Livestock most commonly become infected with rabies through dog or wild animal bites, including bats. Controlling the disease in dogs through vaccination and dog population management remains the most cost-effective way to protect humans from rabies exposure. Wildlife and livestock are often affected, but in much of the world rabies surveillance is limited and the extent of cases is unknown. However, current known cases worldwide in humans, livestock, wildlife and dogs demonstrate that it is a looming public health threat. Prevention and management of rabies at the country level usually involves multiple ministries and can often fall through the cracks because of this, particularly given that it is under-reported as well. Therefore, rabies disease is well-situated to be addressed by the One Health approach in order to safeguard human, animal and ecosystem life.

Conclusion

Over the past eight years, FAO has been at the forefront of the global effort to fight HPAI since its emergence in Southeast Asia. The central role played by FAO to control H5N1 HPAI has been acknowledged by major international agencies and the donor community, particularly given FAO's broad mandate in the area of developing sustainable agriculture for food security, nutrition, food safety and poverty reduction.

The success stories, challenges and lessons learned from these eight years of concerted programming in the region are helping to inform future programming against HPAI and other EIDs. Over the last three to four years FAO's role and priority have evolved. FAO has moved from a focus on emergency response to long-term capacity development to improve technologies and proficiencies in field and market surveillance, and in mechanisms for early detection and timely response in HPAI-infected and at-risk countries. It has broadened its HPAI programme to include other EIDs. And it has adopted a One Health approach to promote greater multisectoral and multidisciplinary participation.

FAO, working with national authorities in endemic countries, has developed a framework for each country. These frameworks are tailored for local differences in the poultry sector, the stage of development of the H5N1 HPAI programme, socio-political characteristics as well as the strengths and weaknesses in both the public and private sectors. Each framework comprises a mix of measures aimed at outbreak control and responses, gathering and analysing information (e.g. surveillance, disease investigations, other epidemiological studies, market chain studies and factors that influence disease reporting, including compensation), disease prevention and risk reduction. Better information allows control and preventive measures to be targeted at the areas facing the greatest threat from the disease. It also improves risk-based interventions. The range of measures builds on those already in place in each country. Each proposed activity has clear measureable objectives and also develops capacity for handling other emerging and re-emerging diseases. Enhanced capacity is especially important given decreasing availability of funds alongside the increasing number of new pathogens and diseases emerging in endemic hotspots in an environment where the interaction between livestock, wild animals and humans is increasing. The approaches to meeting each endemic country's goals are based on progressive control. Each of the identified constraints to the control and prevention of HPAI are addressed, but improvements will be gradual. The road to overcoming these constraints is long and governments and donors must understand that there are no quick fixes to the various institutional and structural issues that led to the disease becoming endemic in the first place. More details can be found in the FAO 2011 publication, *Approaches to controlling, preventing and eliminating H5N1 highly pathogenic avian influenza in endemic countries.*[56]

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[56] Available at http://www.fao.org/docrep/014/i2150e/i2150e00.htm

Without local involvement, buy-in and understanding on all sides, there will not be complete success in addressing pandemic threats or the significant TAD challenges of today. Including this involvement as part of the HPAI programme enabled sustainable successful targeted approaches customized to local needs that were concurrently placed into a regional context. Disease control and elimination efforts were thereby maximized and enhanced. The knowledge gained from HPAI has been successfully transferred to other TADs and has been the impetus behind the formulation of a concerted One Health approach. It has also formed the basis of FAO's One Health AP. Applying the One Health approach in the field, as in the case of farmer and livestock field schools and FETPV training, advantages countries, building residual capacity, knowledge and infrastructure benefits. Requests for midstream animal health work are being met with strategic work that is progressively moving beyond avian influenza. One Health is shifting to PCPs and regional roadmaps for a growing number of TADs such as FMD and brucellosis, and is addressing the semi-neglected diseases such as African trypanosomosis, rabies, African swine fever and PPR.

FAO can continue to contribute significantly as a leader on One Health initiatives and global animal health concerns. Much work remains to be done on wildlife-livestock-human surveillance, training initiatives regarding zoonotic diseases and understanding disease dynamics. FAO can also assist countries in their national efforts to formulate One Health strategic frameworks. The ultimate One Health challenge is working towards biodiversity preservation, sustainable natural resource consumption, and maintaining resilient ecosystem services while decreasing animal and zoonotic disease outbreaks and improving food security globally.

This report will be the last that focuses primarily on the HPAI global programme. Since early 2011, FAO has taken a broad, multisectoral, collaborative One Health approach and is currently implementing the strategic Action Plan (AP) 2011–2015 entitled, Sustainable animal health and contained animal-related human health risks – in support of the emerging One-Health agenda. The AP extends HPAI lessons learned to other animal diseases that threaten animal and human health, rural populations and livelihoods. The AP's goal is to establish a robust global animal health system that effectively manages major animal health risks, paying particular attention to the animal-human-ecosystem interface, and placing disease dynamics into the broader context of agriculture and socio-economic development and environmental sustainability.

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