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## LESSONS FROM HPAI

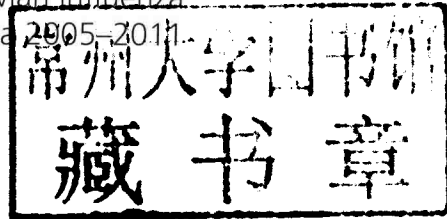
A technical stocktaking of outputs, outcomes, best practices and lessons learned from the fight against highly pathogenic avian influenza in Asia 2005–2011



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# Foreword

Since 2004, the Food and Agriculture Organization of the United Nations (FAO) has been at the forefront of the global effort to fight H5N1 highly pathogenic avian influenza (HPAI), which emerged in Southeast Asia in 2003. At its peak, the disease affected 63 countries in Asia, Europe, the Middle East and Africa, and comprehensive strategies and systems for surveillance, detection, diagnosis and response were put in place at the international, regional and national levels. These strategies, which were developed in consultation with governments, regional organizations and non-governmental organizations – and were implemented by FAO in collaboration with international agencies such as the World Health Organization (WHO), the World Organisation for Animal Health (OIE) and the United Nations Children's Fund (UNICEF) – have begun to prevail. The disease has now been eliminated from most countries in the world, although it remains endemic in parts of Asia including China, Viet Nam, Indonesia, Bangladesh, and in large parts of eastern India. A number of countries in Asia, including Cambodia, the Lao People's Democratic Republic (Lao PDR), Myanmar and Nepal also experience regular sporadic outbreaks. In Africa, Egypt is the only country in which H5N1 HPAI remains entrenched.

Global 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 occasionally spread to humans and cause epidemics and pandemics has spurred politicians and decision-makers to invest in combating the problem of emerging infectious diseases (EIDs). The complexity of the drivers of infectious diseases that have such widespread impact has added impetus to incorporating One Health principles which promote a multidisciplinary and multisectoral approach to addressing the problem.

The central role played by FAO in the global efforts to control H5N1 HPAI has been explicitly acknowledged by major international agencies and by the donor community, particularly given FAO's broad mandate in the area of developing sustainable agriculture for food security, food safety and poverty reduction. The Emergency Centre for Transboundary Animal Diseases (ECTAD), an implementation platform created by FAO in 2004 to strengthen the organization's Emergency Prevention System for Animal Health component (established in 1994), combines the technical and operational expertise of the Animal Production and Health Division (AGA) and the Emergency Operations and Rehabilitation Division (TCE), respectively, and has maintained a strong focus on the control of HPAI. ECTAD's Regional office for Asia and the Pacific (ECTAD-RAP), which was established in Bangkok in 2005, responded to increasing poultry mortality and human infections resulting from HPAI in the region with a comprehensive and dynamic HPAI control programme in Asia. This included the establishment of a South Asia subregional ECTAD Unit based in Kathmandu (2007), and ECTAD units covering over 11 countries in South, Southeast and East Asia.

The success stories, challenges and lessons learned from these seven years of concerted programming in the region are helping to inform and shape the development of future programmes to combat HPAI and other EIDs. 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 the implications for its spread, infectivity and suitability for use in the development of vaccines.

In recent years the world has, regrettably, seen a progressive decline in funding to address the residual threats posed by continued H5N1 HPAI circulation. Political commitment has been on the wane, especially in affected and at-risk countries. This is worrying, as H5N1 HPAI continues to circulate in several countries, and is evolving in environments that present opportunities for the emergence of new variants that may have increased pandemic potential.

The disease is increasingly being under-reported, and efforts at surveillance are declining in most countries that are chronically short of financial and human resources. It is also clear that it would take several years for the endemic countries to eradicate the H5N1 virus from the poultry sector. In addition, a number of other new pathogens and diseases are emerging in the region in an environment where the interaction between livestock, wildlife and humans is increasing. It is, therefore, critical to put greater effort into raising awareness of the potential risks involved, particularly in light of the declining funds available for the control of HPAI and other high-impact diseases.

Over the last three to four years, FAO's role and priority has evolved from that of a predominantly emergency response to one of long-term capacity building to improve surveillance, early detection and response in HPAI-infected and at-risk countries. FAO has also broadened its HPAI programme to include other high-impact diseases and EIDs, and has adopted a One Health approach to promote greater multisectoral and multidisciplinary participation. This transition has provided an opportunity to reflect on the work done so far to control HPAI in the Asia region, and to identify its impact and achievements, success stories, challenges and lessons learned. The *Lessons from HPAI* report represents the outcome of this reflection and brings together in one place the knowledge, insights and recommendations of experts with first-hand knowledge and over eight years' experience of dealing with H5N1 HPAI in Asia.

30 October 2012

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# Abbreviations and acronyms

<b>AAHL</b>	Australian Animal Health Laboratory
<b>ADB</b>	Asian Development Bank
<b>AED</b>	Academy for Educational Development
<b>AEGCD</b>	ASEAN Expert Group on Communicable Diseases
<b>AGA</b>	Animal Production and Health Division (FAO)
<b>AGAH</b>	Animal Health Service
<b>AHI</b>	animal and human influenza
<b>AI</b>	avian influenza
<b>AMS</b>	ASEAN Member States
<b>APEC</b>	Asia-Pacific Economic Cooperation
<b>APRC</b>	Asia-Pacific Regional Conference
<b>AREM</b>	Annual Regional ECTAD Meeting
<b>ASEAN</b>	Association of Southeast Asian Nations
<b>ASEAN+3</b>	Association of Southeast Asian Nations plus China, Japan and Korea
<b>ASWGL</b>	ASEAN Sectoral Working Group on Livestock
<b>AusAID</b>	Australian Agency for International Development
<b>AVET</b>	Applied Veterinary Epidemiology Training
<b>BSL</b>	Biosafety Level (laboratories)
<b>CAHW</b>	community animal health worker
<b>CBO</b>	community-based organization
<b>C&amp;D</b>	cleaning and disinfection
<b>CDC</b>	Centers for Disease Control and Prevention (USA)
<b>CIRAD</b>	Agricultural Research Centre for International Development (France)
<b>CMC-AH</b>	Crisis Management Centre – Animal Health (FAO)
<b>CSIRO</b>	Commonwealth Scientific and Industrial Research Organisation (Australia)
<b>CVO</b>	Chief Veterinary Officer
<b>DAH</b>	Department of Animal Health (Viet Nam)
<b>DIC</b>	Disease Investigation Centre (Indonesia)
<b>DLD</b>	Department of Livestock Development (Thailand)
<b>DVE</b>	duck virus enteritis

<b>ECTAD</b>	Emergency Centre for Transboundary Animal Diseases (FAO)
<b>EIDs</b>	emerging infectious diseases
<b>EMPRES</b>	Emergency Prevention System (FAO)
<b>EPT</b>	Emerging Pandemic Threats programme (USA)
<b>EU</b>	European Union
<b>FAVA</b>	Federation of Asian Veterinary Associations
<b>FMD</b>	foot-and-mouth disease
<b>FAO</b>	Food and Agriculture Organization of the United Nations
<b>FETPV</b>	Field Epidemiology Training Programme for Veterinarians
<b>GAINS</b>	Global Animal Information System
<b>GETS</b>	Gathering Evidence for a Transitional Strategy project (Viet Nam)
<b>GF-TADs</b>	Global Framework for the Progressive Control of Transboundary Animal Diseases (FAO/OIE)
<b>GIS</b>	geographic information systems
<b>GPS</b>	Global Positioning System
<b>GLEWS</b>	Global Early Warning System
<b>H1N1</b>	subtype of influenza A virus
<b>H5N1</b>	subtype of influenza A virus
<b>HPAI</b>	highly pathogenic avian influenza
<b>HPED</b>	highly pathogenic emerging disease
<b>IEC</b>	information, education and communication
<b>IGP</b>	Indo-Gangetic Plain
<b>ILRI</b>	International Livestock Research Institute
<b>IMCAPI</b>	International Ministerial Conference on Avian and Pandemic Influenza
<b>INGO</b>	international non-governmental organization
<b>IPC</b>	Institut Pasteur in Cambodia
<b>ISO</b>	International Organization for Standardization
<b>IVM</b>	influenza virus monitoring
<b>KAP</b>	knowledge, attitudes and practices
<b>KOR</b>	Republic of Korea
<b>LBM</b>	live bird market
<b>LL</b>	leading laboratory
<b>MoA</b>	Ministry of Agriculture
<b>MoH</b>	Ministry of Health

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<b>NAHICO</b>	National Avian and Human Influenza Coordination Office (Lao PDR)
<b>NaVRI</b>	National Veterinary Research Institute (Cambodia)
<b>ND</b>	Newcastle disease
<b>NEIDCO</b>	National Emerging Infectious Diseases Coordination Office (Lao PDR)
<b>NGO</b>	non-governmental organization
<b>NSCAI</b>	National Steering Committee for Avian Influenza (Viet Nam)
<b>OFFLU</b>	OIE/FAO Network of expertise on animal influenza
<b>OIE</b>	World Organisation for Animal Health
<b>OSU</b>	Oklahoma State University
<b>PAHI</b>	Partnership on Avian and Human Influenza
<b>PCR</b>	polymerase chain reaction
<b>PDSR</b>	Participatory Disease Surveillance and Response (Indonesia)
<b>PPP</b>	public-private partnership
<b>PRK</b>	Democratic People's Republic of Korea
<b>PRRS</b>	porcine respiratory and reproductive syndrome
<b>PT</b>	proficiency testing
<b>QA</b>	quality assurance
<b>QM</b>	quality management
<b>RAP</b>	Regional office for Asia and the Pacific (FAO)
<b>RCM</b>	Regional Coordination Mechanism
<b>RDMA</b>	Regional Development Mission for Asia (USAID)
<b>RNA</b>	ribonucleic acid
<b>RT-PCR</b>	reverse transcriptase polymerase chain reaction
<b>RSU</b>	Regional Support Unit
<b>SAARC</b>	South Asian Association for Regional Cooperation
<b>SARS</b>	Severe Acute Respiratory Syndrome
<b>SEARO</b>	South-East Asia Regional Office (WHO)
<b>SEPRL</b>	Southeast Poultry Research Laboratory (USA)
<b>SMS</b>	short message service
<b>SOP</b>	Standard Operating Procedure
<b>TADs</b>	Transboundary Animal Diseases
<b>TCE</b>	Emergency Operations and Rehabilitation Division (FAO)
<b>TCP</b>	Technical Cooperation Programme (FAO)
<b>TOT</b>	training of trainers



<b>UN</b>	United Nations
<b>UNEP-CMS</b>	United Nations Environmental Programme – Convention on Migratory Species
<b>UNJP</b>	United Nations Joint Programme
<b>UNICEF</b>	United Nations Children's Fund
<b>UNDP</b>	United Nations Development Programme
<b>UNSIIC</b>	United Nations System Influenza Coordination
<b>UNTGH</b>	United Nations Theme Group on Health
<b>USAID</b>	United States Agency for International Development
<b>USDA</b>	United States Department of Agriculture
<b>USGS</b>	United States Geological Survey
<b>VAHW</b>	village animal health worker
<b>VBEC</b>	village-based biosecurity, education and communication
<b>VVW</b>	village veterinary worker
<b>WAHIS</b>	World Animal Health Information System (OIE)
<b>WB</b>	World Bank
<b>WCS</b>	Wildlife Conservation Society (USA)
<b>WEE</b>	wildlife, ecology and environment
<b>WHO</b>	World Health Organization
<b>WILD</b>	Wildlife Investigation in Livestock Disease and Public Health (FAO)
<b>WPRO</b>	Western Pacific Regional Office (WHO)

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# Contents

Foreword	vii
Abbreviations and acronyms	ix
Acknowledgements	xiii
<b>Introduction</b>	<b>1</b>
The global response	3
FAO's response	3
Why this report?	4
<b>Coordination</b>	<b>7</b>
Situation in 2005	8
Situation in 2011	9
Outputs	13
Outcomes	13
Successful practices	14
Sustainability	14
The future	14
<b>Surveillance</b>	<b>17</b>
Situation in 2005	19
Situation in 2011	20
Outputs	26
Outcomes	27
Successful practices	27
Lessons learned	28
Sustainability	29
The future	29
<b>Laboratory capacity</b>	<b>31</b>
Situation in 2005	32
Situation in 2011	32
Outputs	34
Outcomes	35
Successful practices	35
Lessons learned	36
Sustainability	37
The future	37

<b>Vaccination</b>	<b>39</b>
Situation in 2005	39
Situation in 2011	41
Outputs	45
Outcomes	45
Lessons learned	45
Sustainability	47
The future	47
<b>Biosecurity</b>	<b>49</b>
Situation in 2005	50
Situation in 2011	51
Outputs	53
Outcomes	54
Lessons learned	54
Sustainability	55
The future	55
<b>Socio-economics</b>	<b>57</b>
Situation in 2005	57
Situation in 2011	59
Outputs	64
Outcomes	64
Best practices	64
Lessons learned	65
Sustainability	66
The future	66
<b>Wildlife</b>	<b>69</b>
Situation in 2005	69
Situation in 2011	70
Outputs	73
Outcomes	73
Successful practices	74
Sustainability	74
The future	74

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<b>Communication and advocacy</b>	<b>75</b>
Situation in 2005	76
Situation in 2011	76
Outputs	81
Outcomes	81
Successful practices	82
Lessons learned	82
Sustainability	83
The future	84
<b>Lessons learned</b>	<b>85</b>
Policy	85
Coordination	85
Surveillance	86
Epidemiology	86
Laboratory capacity	86
Biosecurity	87
Socio-economics	87
Communication	88
<b>References</b>	<b>91</b>

# Introduction

The emergence and rapid spread of a zoonotic H5N1 highly pathogenic avian influenza (HPAI) in Southeast Asia in 2003 and 2004 triggered worldwide interest and response, particularly owing to the ability of the H5N1 virus to kill large numbers of infected animals, thereby threatening food security and safety, and the livelihoods of millions of poor livestock farmers. By the time the disease appeared in Southeast Asia, the zoonotic potential of the virus was well recognized. Soon afterwards, a number of human cases and deaths were reported in Viet Nam and Thailand, coinciding with cases in domestic poultry. In 2005, when HPAI spread outside Southeast Asia into Russia, Europe and Africa, the potential for the huge impact of this disease on the global community was clear. This led to an unprecedented response from international organizations and donors to mobilize resources for containing and eliminating the disease.

While aquatic birds are the natural reservoirs of influenza viruses, it is well recognized that, from time to time, the viruses spread and adapt to domestic poultry and then to humans. During this process, influenza viruses increase in terms of their severity and, occasionally, cause influenza pandemics. A number of animal influenza viruses (subtypes H2, H5, H6, H7 and H9) have sporadically infected humans and are considered to have pandemic potential. Since the emergence of H5N1 in 2003, the virus has infected over 600 people worldwide and over half of the infected population have died from the disease. This number is still relatively low. At present, the virus is mainly confined to domestic poultry and

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has not demonstrated that it can be transmitted effectively between humans. However, although human infections remain rare and sporadic, the potential for the emergence of pandemic human influenza from H5N1 still remains.

Since the emergence of H5N1 HPAI in 2003, the disease situation has evolved considerably. At the peak of avian influenza (AI) outbreaks in 2006, 63 countries in Asia, Europe and Africa were affected by the disease; it has now been eliminated from most of these countries. H5N1 is currently entrenched in a number of countries in Asia and the disease is endemic in China, Viet Nam, Indonesia, Bangladesh and large parts of eastern India. A number of countries in Asia, including the Lao People's Democratic Republic (Lao PDR), Cambodia, Myanmar and Nepal, also experience regular outbreaks.

The period 2004 to 2008 saw a steady decline in disease outbreaks in poultry. While there has been an apparent increase in outbreak numbers since 2009, the 2011/2012 HPAI season saw a significant decline in poultry outbreaks. The last newly-infected country was Bhutan; this outbreak took place in February 2010. However, the disease is known to be under-reported and there is increasing evidence that H5N1 HPAI has become endemic in some of the smaller countries in Asia that have relatively undeveloped poultry industries; such countries include Cambodia and Nepal. It is estimated that the disease has resulted in the loss of over 400 million domestic poultry and has caused economic losses of over US\$20 billion.

The H5N1 virus itself has evolved progressively in Asia. Between 2003 and 2007, the H5N1 clades 1 and 2 were the most common. The latter clade progressively replaced clade 1 and, by 2005, it had become the dominant strain globally. Clade 2 has evolved rapidly and has generated a number of subclades in different epidemiological situations in Asia. Of the H5N1 clade 2 viruses, clade 2.2, found in the Indo-Gangetic Plain (IGP) area including Bangladesh, Nepal and India, has been the most common. 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 northern Viet Nam the subclade 2.3.4 has been predominant, replacing the previously dominant clade 1 and the newly introduced clade 7. In southern Viet Nam only clade 1 has been observed and it continues to be the most important strain of virus present. Cambodia shares the same epidemiological environment and clade as southern Viet Nam. Lao PDR and Myanmar have had multiple incursions of H5N1 viruses with outbreaks caused by clades 1, 2.3.4 and 2.3.2 in the former, and 7, 2.2 and 2.3.4 in the latter. Thailand, which is now free of H5N1 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 caused by this clade, which seems to have evolved in domestic poultry in China and also appears to possess altered characteristics with high pathogenicity to wild birds. This virus has been known to spread widely in Asia through infected wild birds, and has affected Bangladesh, India, Japan, Myanmar, Nepal and the Republic of Korea (KOR). Clade 2.3.2 in its various forms exists in China together with clade 2.3.4.

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 the implications for its spread, infectivity and suitability for use in the development

of vaccines. The current trends in evolution present a number of concerns, which 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.

## THE GLOBAL RESPONSE

As part of the global effort to control AI and reduce the risk of a human pandemic, a series of high-level international ministerial conferences on avian and pandemic influenza (IMCAPI) were organized by international technical organizations and the donor community. These consultations, held in Beijing (2005), Bamako (2006), New Delhi (2007), Sharm el Sheikh (2008) and Hanoi (2010), have consistently acknowledged that the risk of pandemic influenza can only be reduced by controlling the disease at source in poultry. In this regard, major international agencies and the donor community have recognized the important role of the Food and Agriculture Organization of the United Nations (FAO) in controlling this disease, particularly given FAO's broad mandate related to the development of sustainable agriculture for food security, food safety and poverty reduction. The IMCAPI meetings have also been influential in generating political and financial support for addressing the HPAI problem.

## FAO'S RESPONSE

FAO has played a central and leading role in global efforts to control H5N1 HPAI. In 2004, FAO created the Emergency Centre for Transboundary Animal Diseases (ECTAD), an implementation platform for addressing the global issues of HPAI as an operational support for its Emergency Prevention System for Animal Health component (established in 1994). ECTAD was born out of a partnership between FAO's technical expertise, embodied in the Animal Production and Health Division (AGA), and its emergency operations expertise, represented by its Emergency Operations and Rehabilitation Division (TCE). ECTAD's Regional office for Asia and the Pacific (RAP) was established in Bangkok in 2005 in response to increasing poultry mortality and human infections due to HPAI in South, Southeast and East Asia. By 2007, FAO had a large HPAI control programme in Asia, with a South Asia subregional ECTAD Unit based in Kathmandu, and country ECTAD units covering over 11 countries in South, Southeast and East Asia. Driven by a clear, decentralized chain of command from the FAO Chief Veterinary Officer (CVO), in his role as the Head of ECTAD, through to the Regional Manager and the country Team Leaders, and supported by clear and synergistic global, regional and national strategies for HPAI control, the ECTAD platform provided an effective model for emergency implementation of a high-impact emerging disease control programme.

FAO's principal role in using the ECTAD platform may be broadly grouped under two headings: coordination and technical support. The coordination role has been significant in forging productive partnerships with national governments, regional organizations, national non-governmental organizations (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 for-



mal relationship with ministries of agriculture in respective member countries has enabled the rapid development, establishment and implementation of national HPAI programmes. The technical expertise has fostered programmes to improve the capacity to quickly detect, diagnose, report and respond to a disease emergency. Through its technical advice and support, FAO has enhanced regional cooperation and has promoted greater transparency in sharing disease information through the establishment of regional diagnosis and surveillance networks in collaboration with regional organizations. FAO has also been able to form and mobilize multidisciplinary teams, including communicators, socio-economists, wildlife experts, epidemiologists, virologists, molecular biologists and public-private partnership experts, to address an extremely complex disease problem of global significance.

Global efforts to address the threats and impact of H5N1 HPAI have yielded significant results. The understanding that a pathogen that predominantly causes losses in livestock can spread to humans and cause epidemics and pandemics has spurred politicians and decision-makers to invest in combating the problem of emerging infectious diseases (EIDs). The complexity of the drivers of infectious diseases has stimulated the development of a One Health approach that promotes multidisciplinary and multisectoral collaboration in addressing the problem. When pandemic H1N1 influenza emerged in 2009, two factors that prompted the well-coordinated global response by various countries and international and regional organizations were increased awareness of such high-impact global problems and enhanced capacity to address them.

### WHY THIS REPORT?

FAO continues to play a key role in the global response to HPAI. At its peak, the ECTAD programme comprised 168 donor-supported projects, of which 64 remain active, more than half of them in Asia. From 2010 onwards, there has been a progressive decline in funding



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