

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 Influenza, 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 advanc-

es 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 per cent 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 Friedrich-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 (VVs) 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

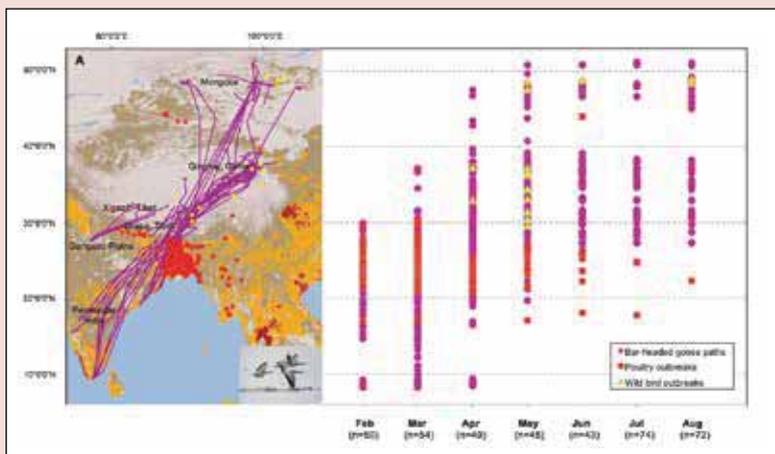
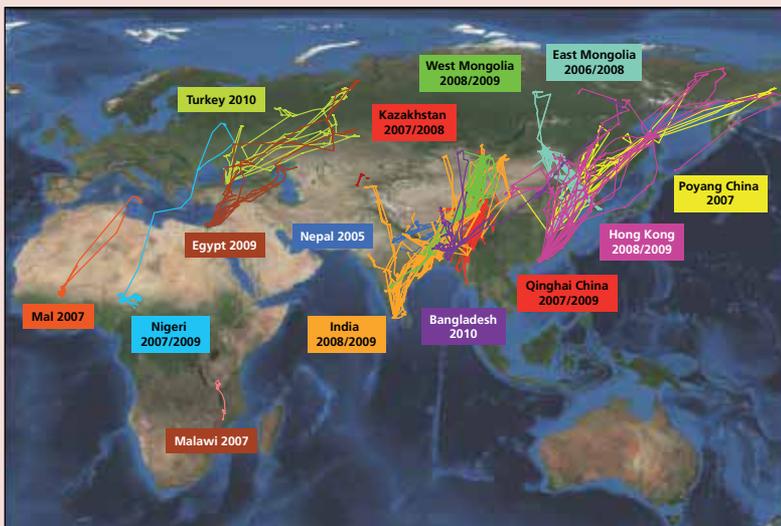
Over the past six to seven years, FAO and other organizations have collected approximately 750 000 samples from healthy, free-ranging wild birds including waterfowl, waders, shorebirds and passerines. The surveillance results demonstrate that wild birds are not the reservoir for HPAI H5N1.

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 publicly 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 in 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 health 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 efficiency 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.



ENDEMIC COUNTRY SITUATION UPDATE SNAPSHOTS

Bangladesh

2011 Disease situation overview

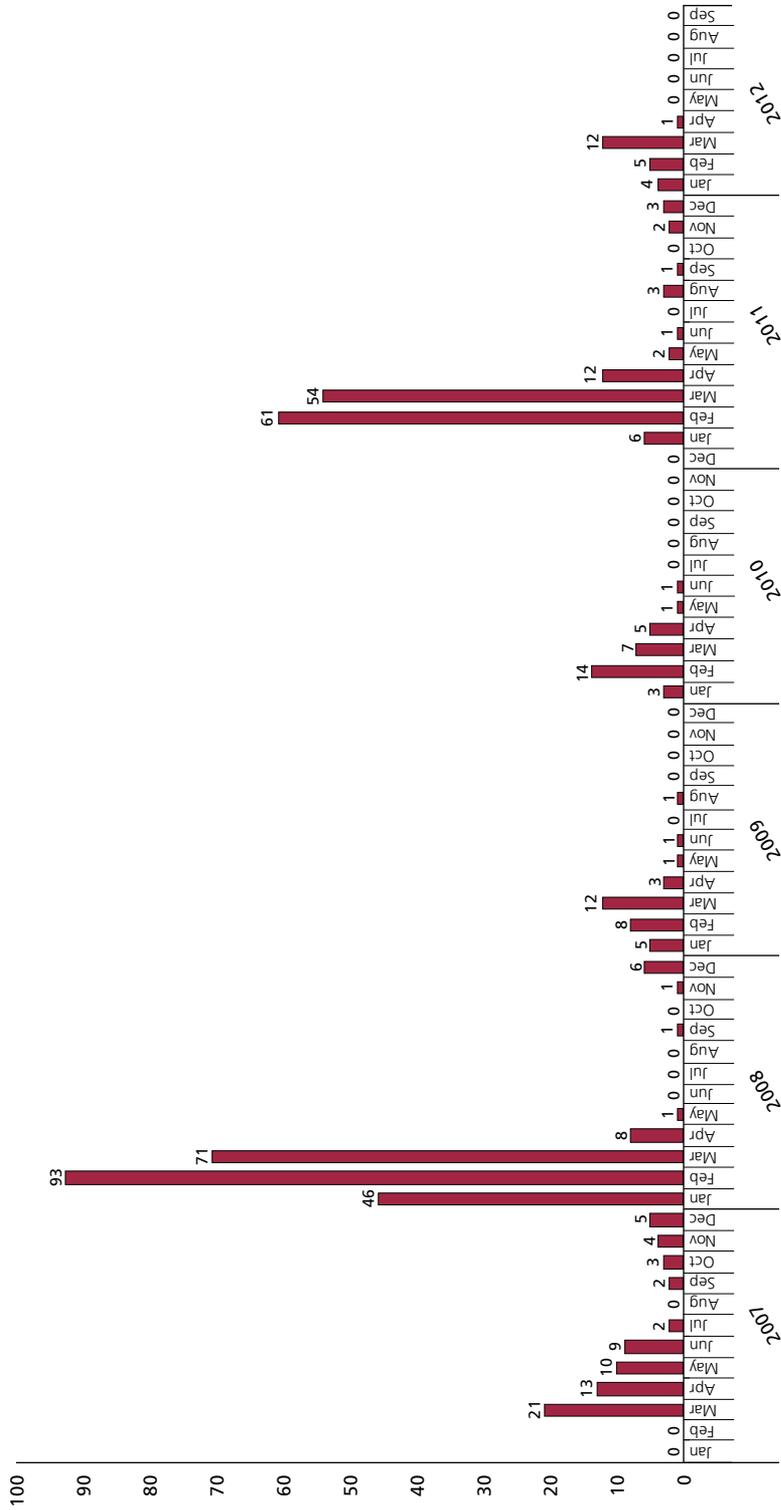
During 2011, **Bangladesh** (see Figure 3.1) experienced an increase in outbreak numbers in poultry (from 31 in 2010 to 145 in 2011), mostly in commercial poultry from five areas, three of which were infected during 2010. Areas affected in Bangladesh were Barisal, Chittagong, Dhaka, Khulna, Rajshahi 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.

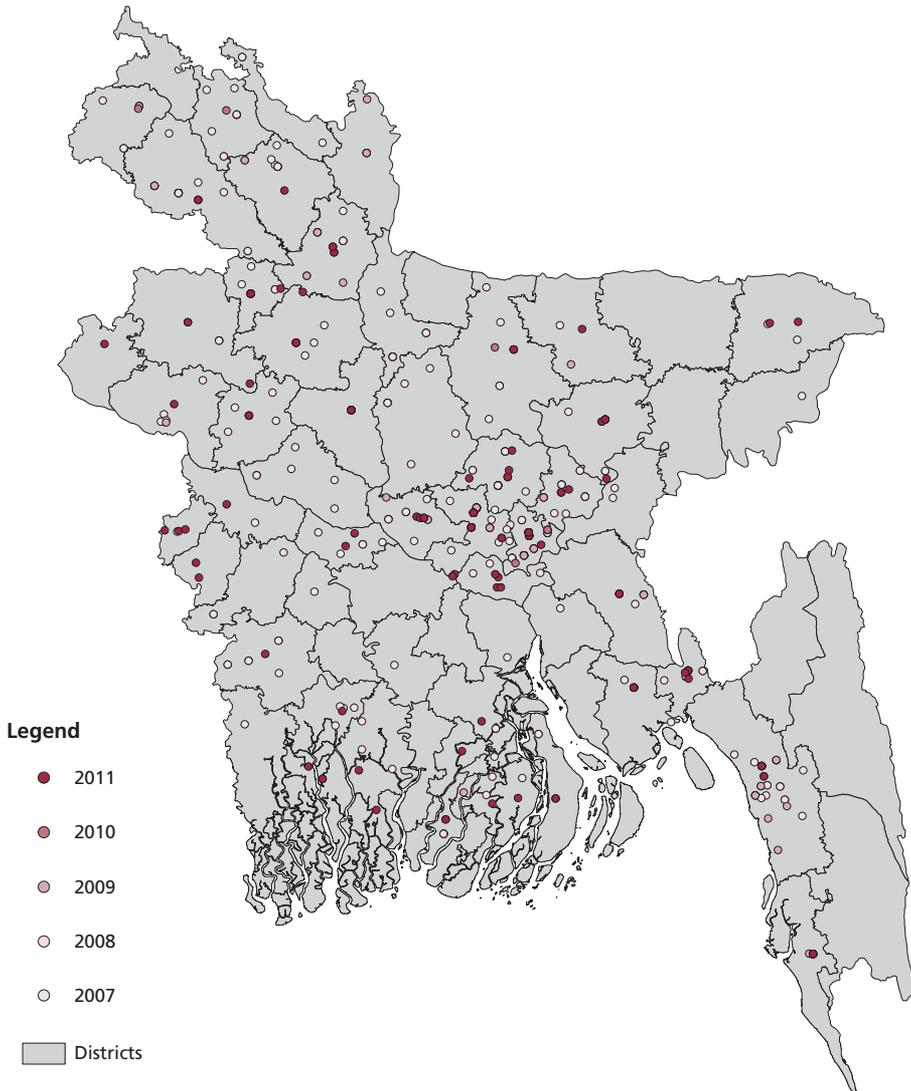
FAO is coordinating and supporting active surveillance that has been expanded to 306 upzalias (subdistricts) across the country, including the innovative use of the SMS gateway as a reporting tool. Daily, in each upzalia, avian influenza workers (AIWs; formerly designated CAHWs) employed by the active 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-1.

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 south-eastern part of the country (see Figure 3.4).



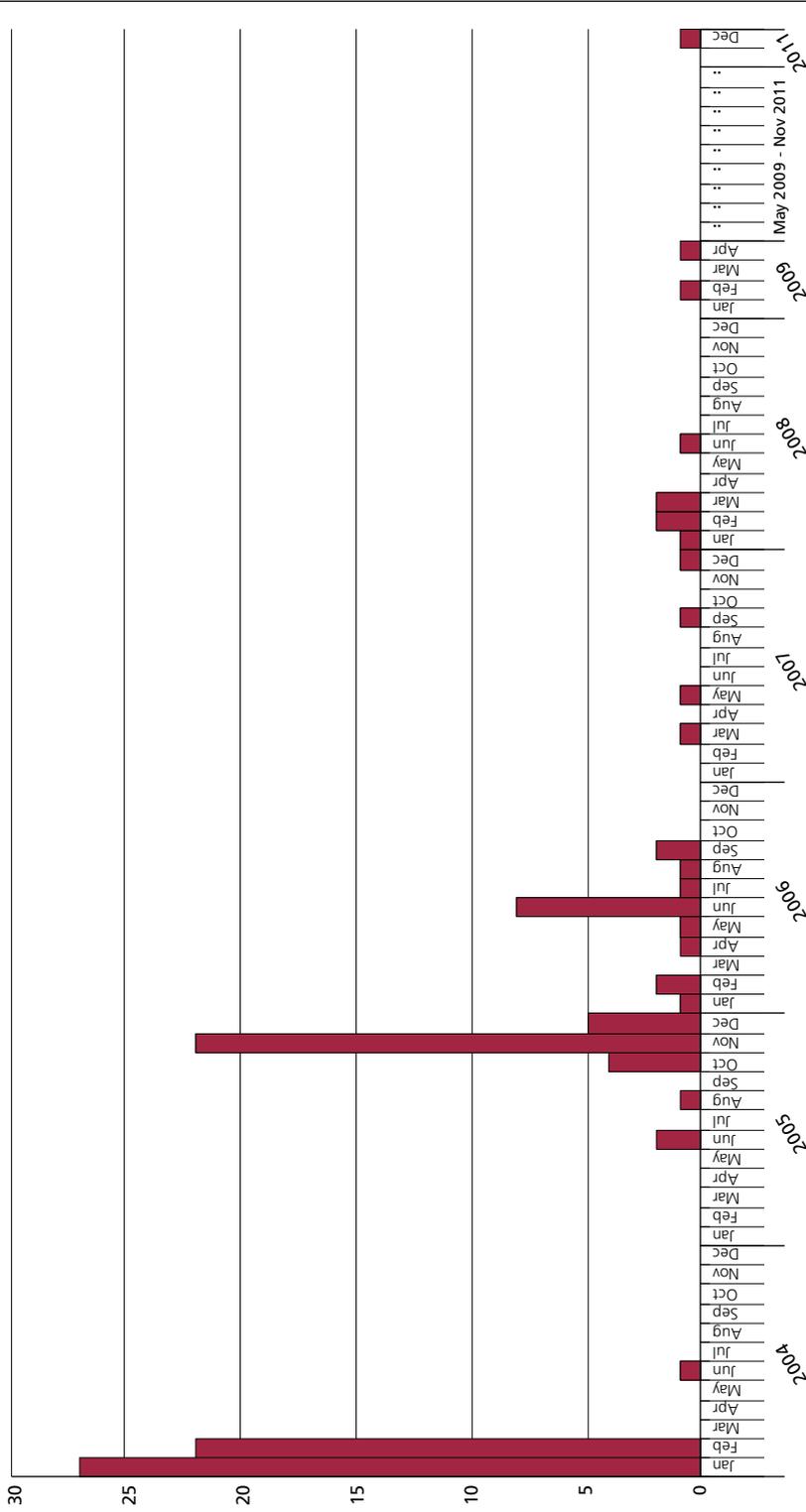
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Current and future issues overview

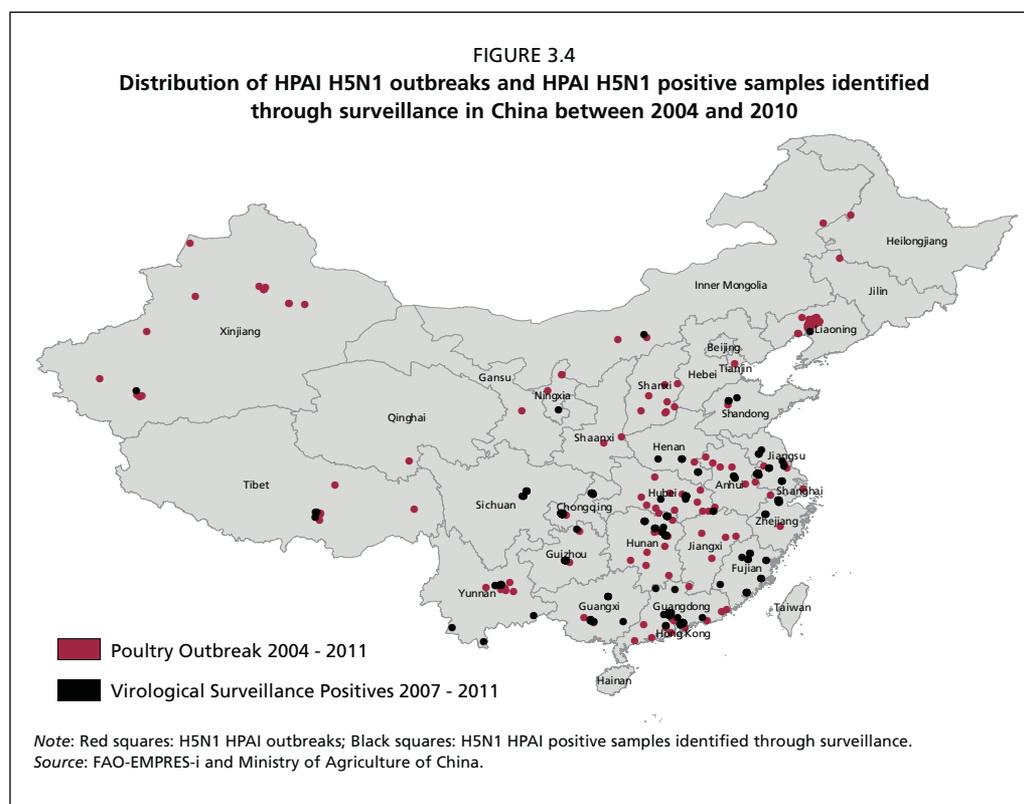
China has been at the forefront of vaccine development for AI. FAO provides support to China by way of epidemiological training and advice with respect to assessment of vaccination, and advice on the general performance of the mass vaccination programme. China has instituted a mass vaccination programme 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.



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

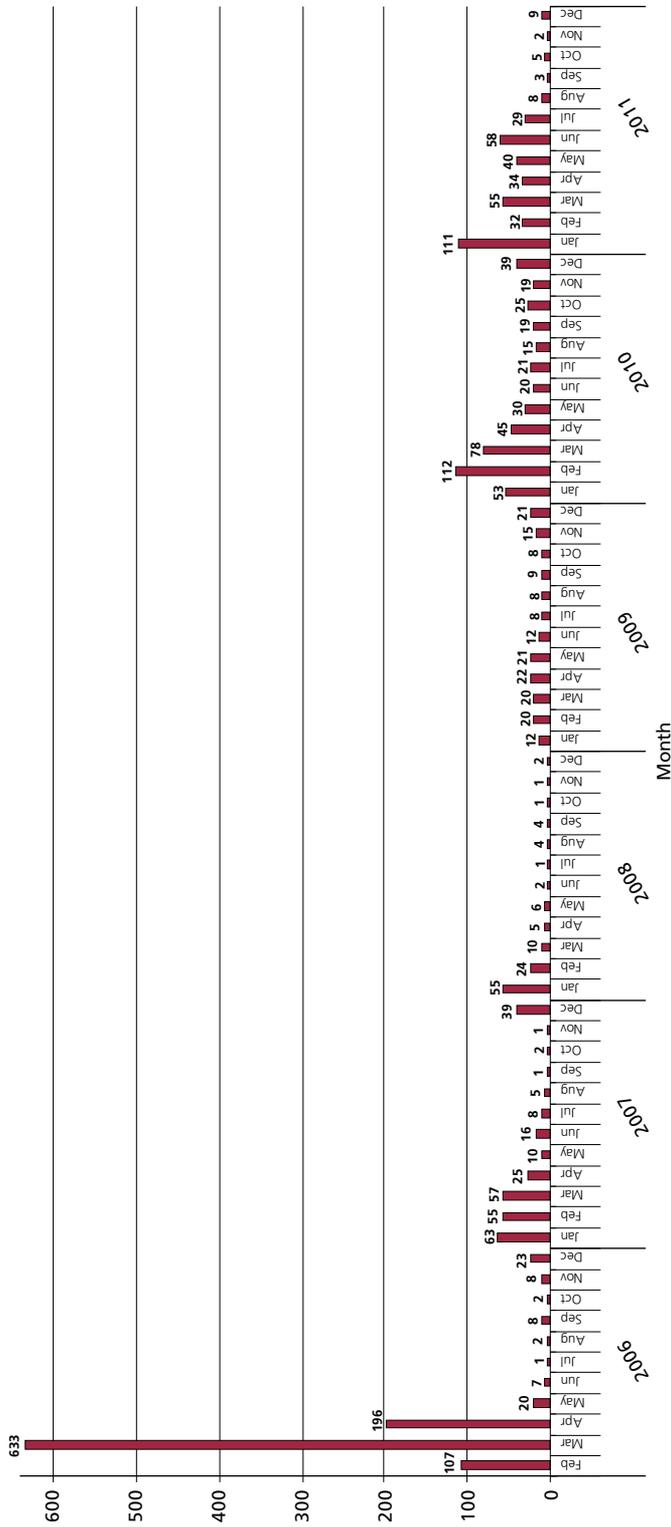


programme implementation further by slowing or disrupting the delivery of government services. **Egypt** continued to report large numbers of outbreaks predominantly in the household poultry sector during 2011 to January 2012 in most of its 29 governorates. Compared to 2010, the number of outbreaks reported 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

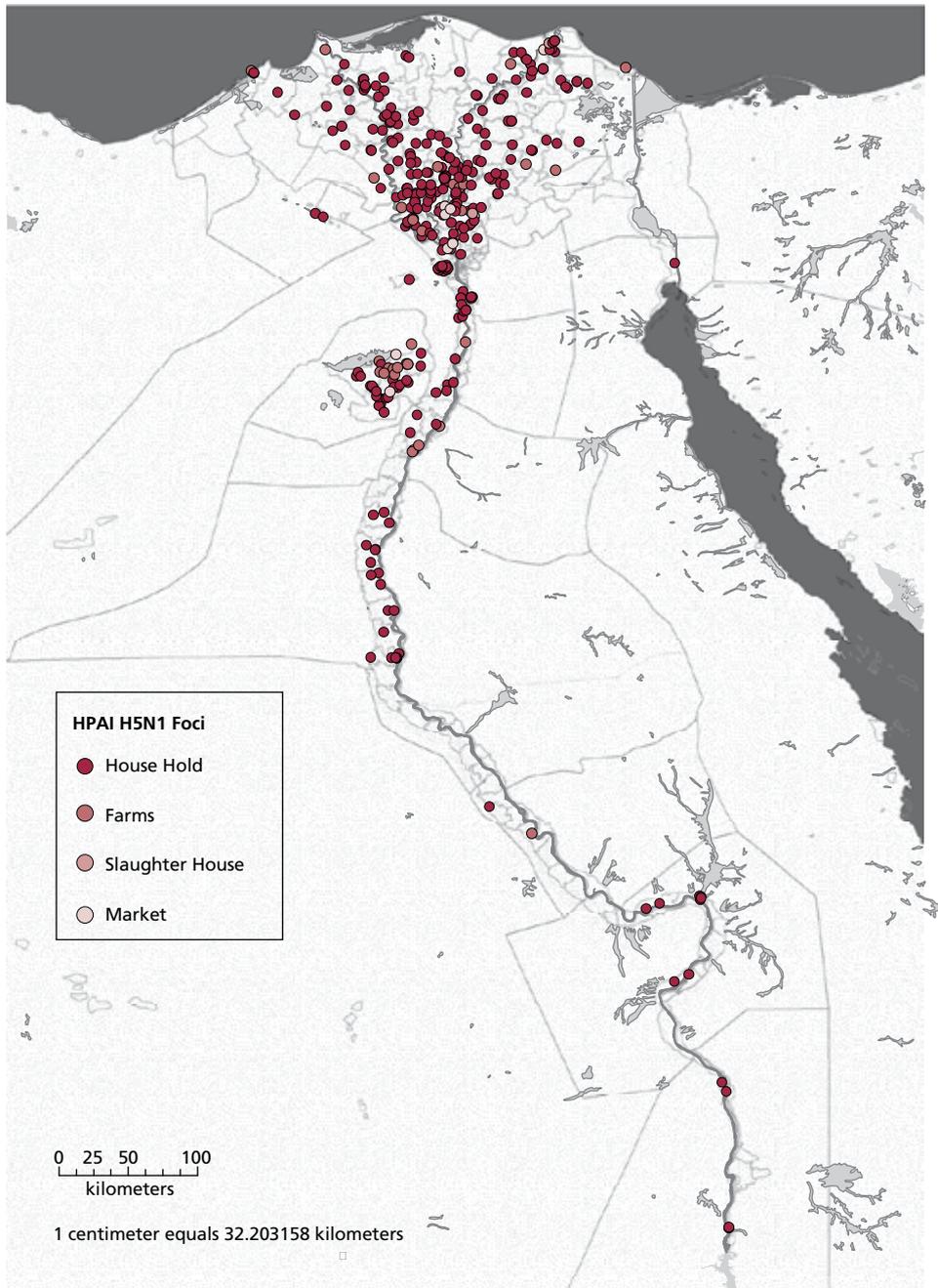
Egypt has large and dense poultry and human populations with most of the poultry farms located in the Nile Delta region. Poultry is a major source of animal protein and income. About 80 percent of commercial farms are not licensed, and a significant proportion of farms operate in rental facilities with 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

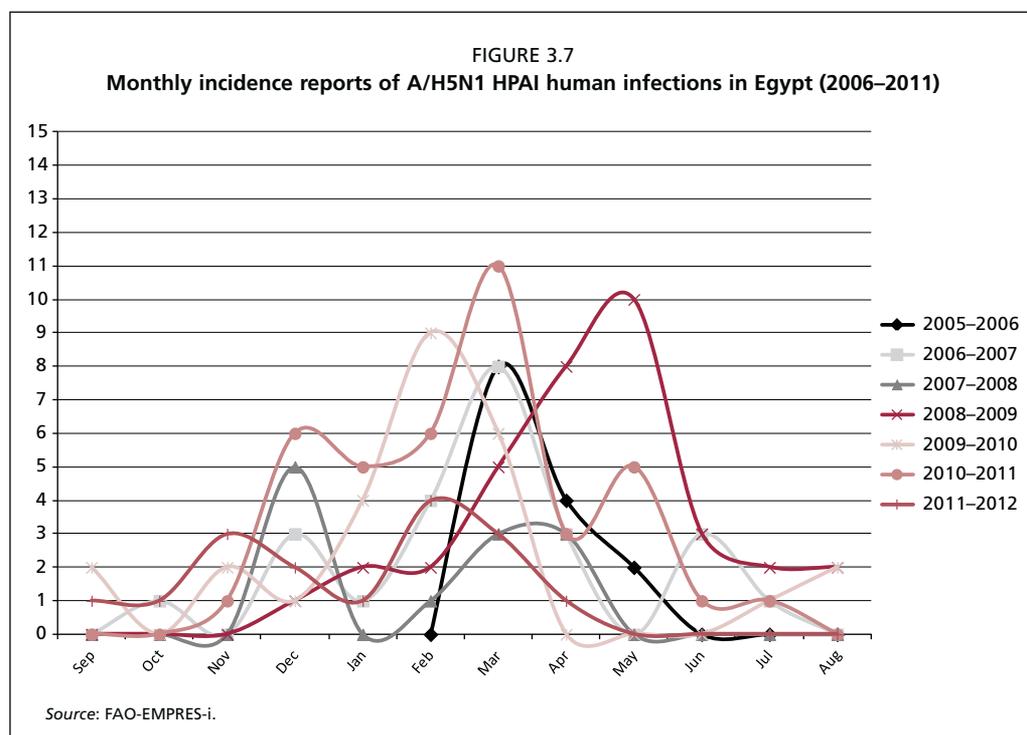


Note: Total number of monthly reported HPAI outbreaks in Egypt: 2442. Total number of reported outbreak in 2011: 286.
 Source: FAO-EMPRES-i.

FIGURE 3.6
Spatial distribution of H5N1 HPAI outbreaks in Egypt 2011



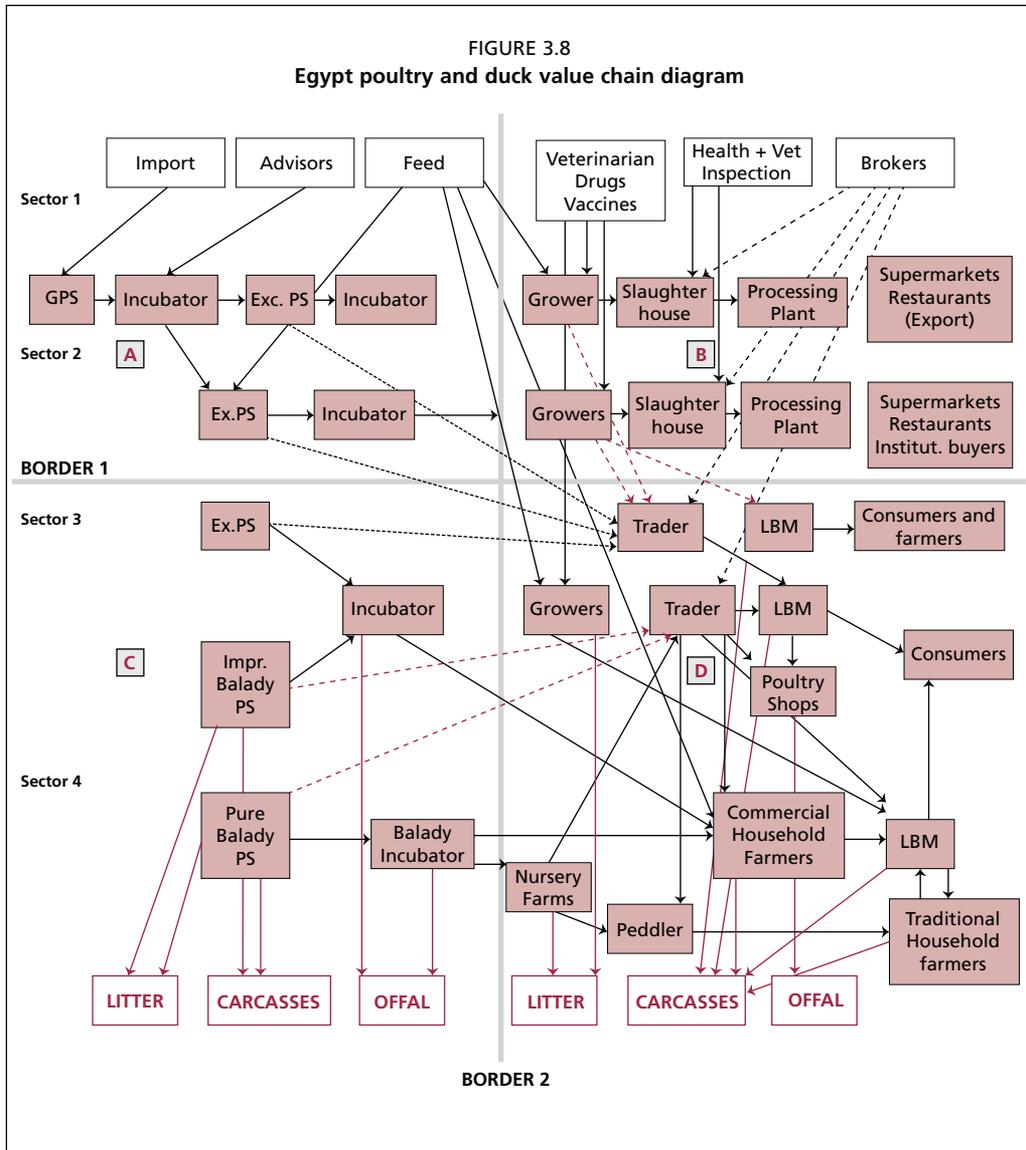
Source: GOVS, Central administration for preventive medicine, Epidemiology department.



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



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 policies, 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.

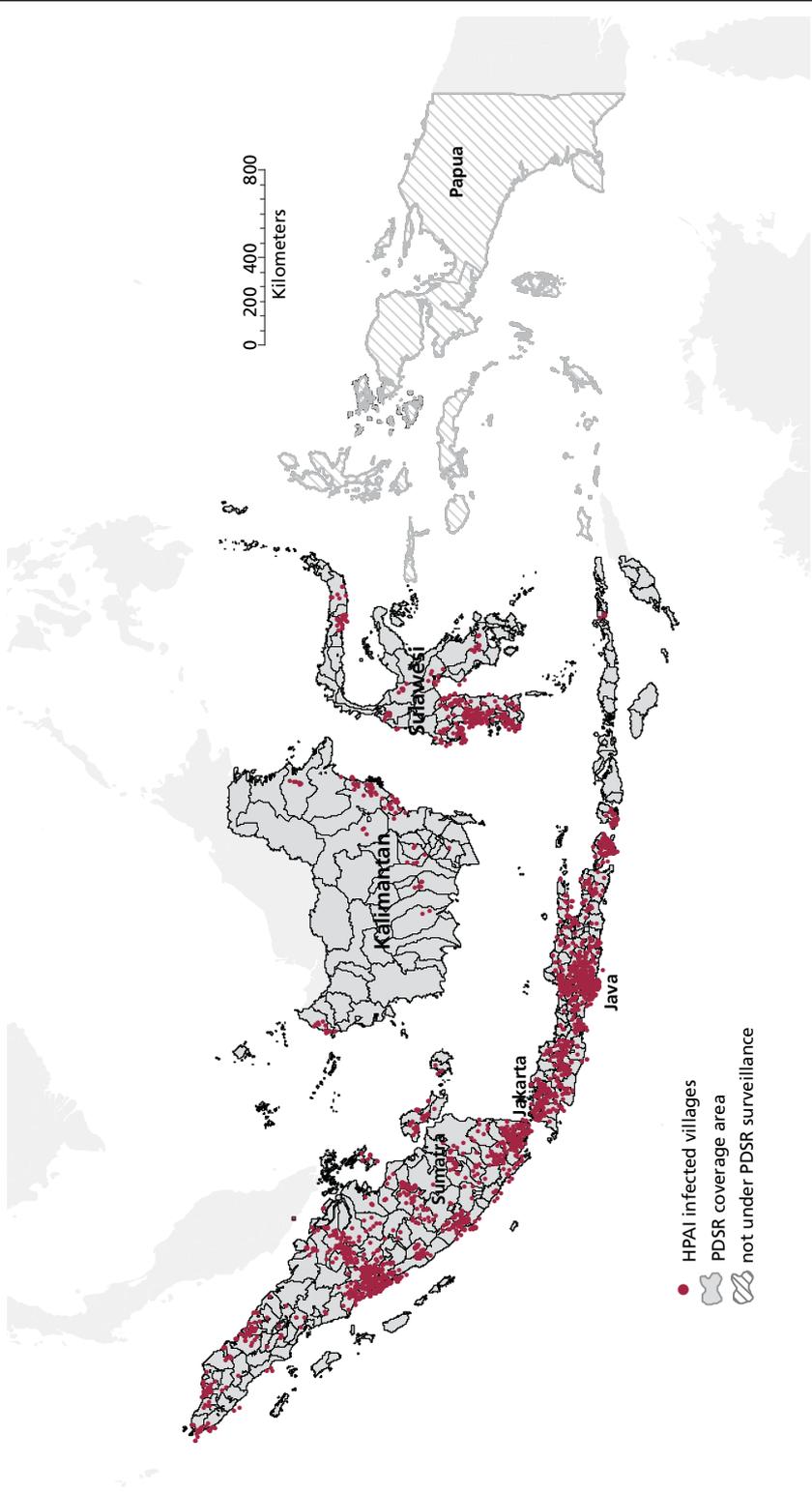
The Influenza Virus Monitoring Laboratory Network for Animal Health (IVM-AH) is composed of national animal health laboratories that participate in virus detection and isolation, and conduct initial antigenic profiling through haemagglutination inhibition testing using a specialized panel of reference 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

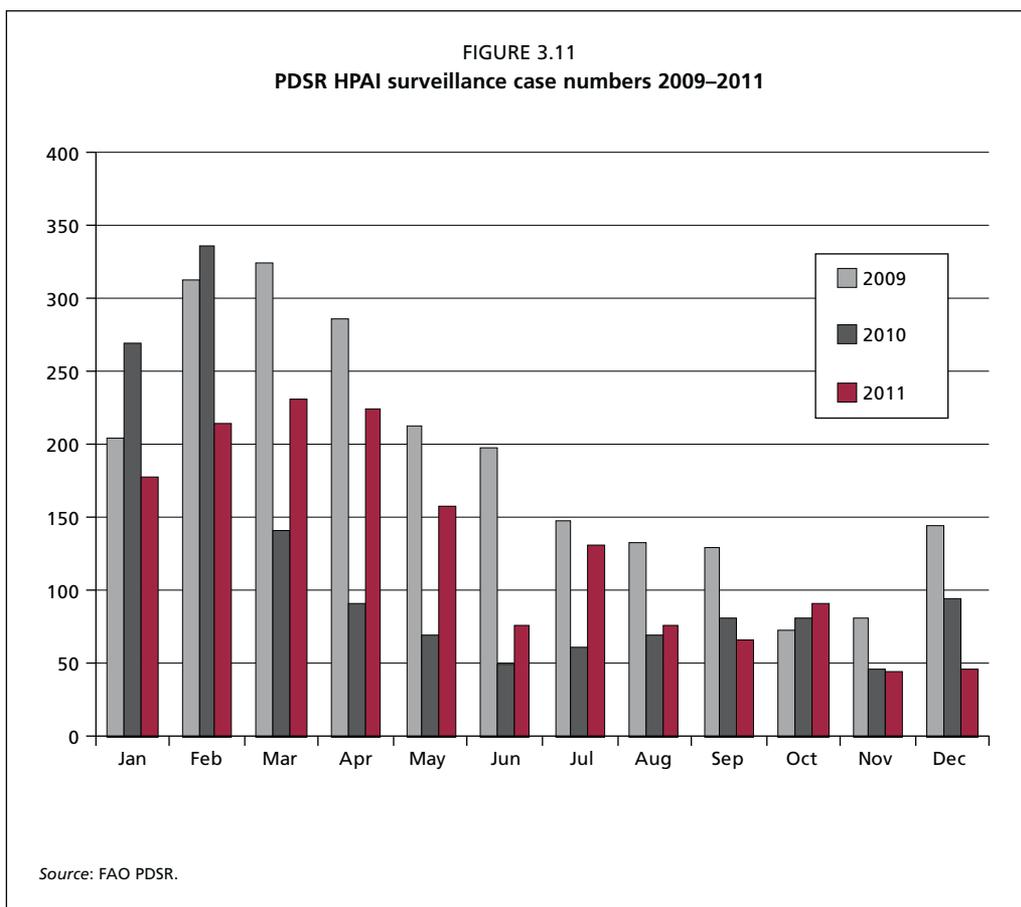
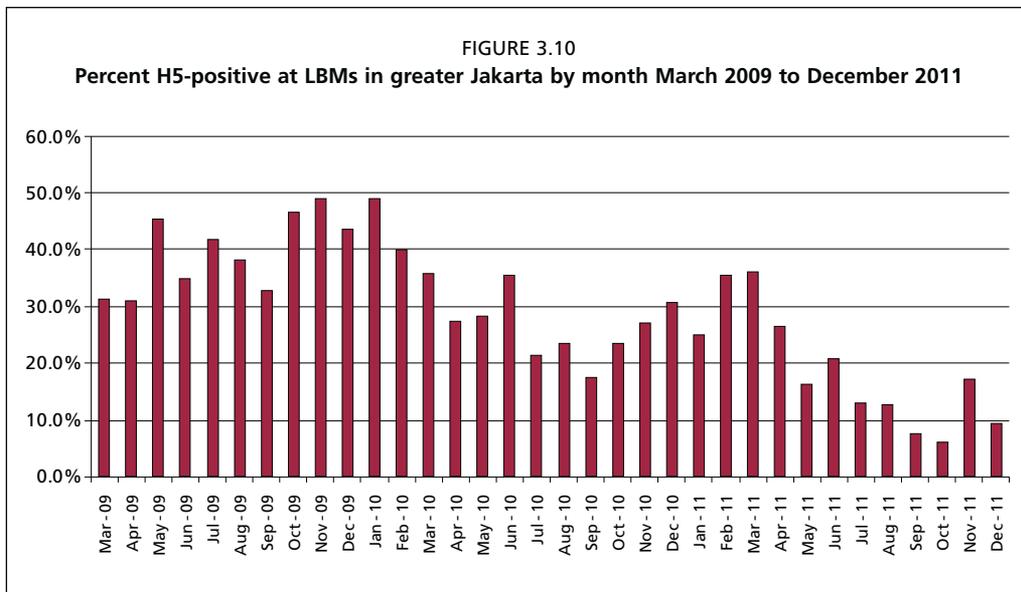
Because vaccination efforts in Indonesia for the commercial sector are not formally supported nor coordinated by the government, there is a need to engage industry as a major stakeholder and to strengthen ties through public-private partnerships. The Directorate of Animal Health and FAO have engaged 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.

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

FIGURE 3.9
H5N1 HPAL spatial distribution in Indonesia 2011



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



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-



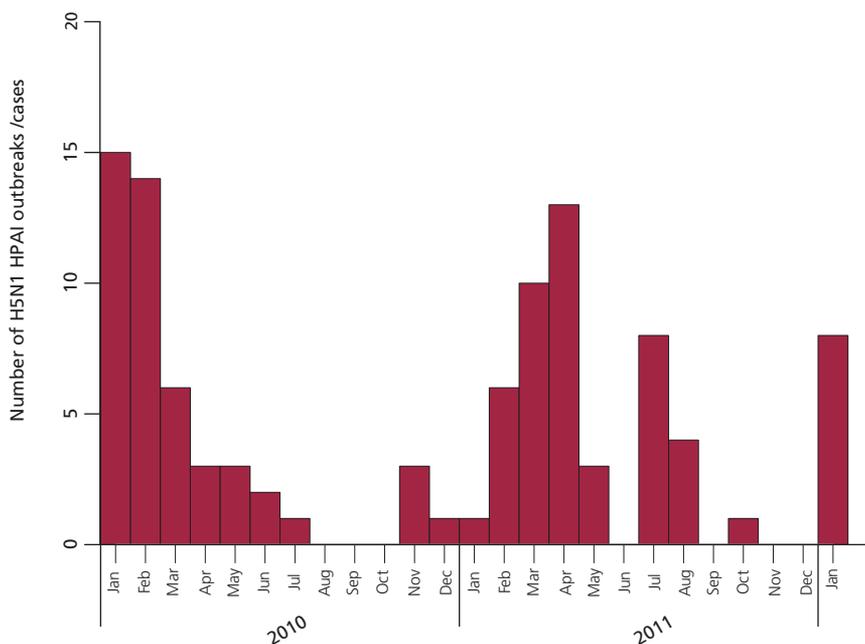
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parable to that observed in 2010 with 21 out of 64 provinces affected. Surveillance and molecular genetics analysis have indicated the presence of four circulating virus clades in Viet Nam since 2003. These are: (1) clade 1.1 (predominant in southern 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.