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Resource Paper 2

**H5N1 Highly Pathogenic Avian Influenza:
ensuring an appropriate and sustainable
response**



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Structure and Objectives of this Paper

H5N1 highly pathogenic avian influenza (HPAI) virus continues to circulate in several regions of the world, straining healthy poultry production and thus impacting the livelihoods of millions of people, whilst also remaining a disease with a high case fatality rate in humans, and a potential pandemic influenza threat.

Section 2.1 of this paper reviews the disease status of H5N1 HPAI in domestic poultry and wildlife in affected countries. Section 2.2 examines progress to strengthen healthy poultry production, control the spread of H5N1 and mitigate its impacts, including through surveillance, laboratory networks, vaccination strategies, epidemiological analysis, biosecurity enhancement and understanding socio-economic factors. Section 2.3 considers sustained approaches for progressive control, what is different about this approach and why it is important. Section 2.4 reviews barriers to progressive control and examines areas that require increased attention to help control and eliminate H5N1 from domestic poultry in the future, thereby minimising risks for human health.

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2.0 Executive Summary

Given the continued circulation, significant impacts and potential risks of H5N1 HPAI, this paper supplements the overview provided in Paper 1 with a more detailed review of H5N1 HPAI virus status in domestic poultry, wild birds, other animal species, and humans in affected countries. The paper reviews progress with control of H5N1 HPAI, and considers sustained progressive control, what is different about this approach and why it is important. The paper also provides an analysis of barriers to achieving progressive control and areas for greater focus.

H5N1 HPAI remains entrenched in domestic poultry in Bangladesh, China, Egypt, Indonesia and Vietnam. Egypt and Vietnam have experienced an increased number of outbreaks in 2009, compared with 2008. Other countries that continue to be affected by outbreaks include Cambodia, Lao PDR, India, Nepal and Myanmar. A reduced number of wild bird outbreaks were reported in 2009, though transmission of the disease from wild birds to poultry, or to other animal host species remains a concern.

While no new countries have reported human cases of H5N1 HPAI, the number of human cases reported in 2009 has doubled from 2008, particularly in Egypt and Vietnam. All human cases have occurred in countries with ongoing circulation or reintroduction of H5N1 viruses in poultry. Surveillance for human cases has remained the same for all countries other than Egypt, which in 2009 significantly reduced the average time between symptom onset and hospitalization, and reduced CFRs to ten percent. The risk of mutation or reassortment of influenza A viruses remains a concern.

Mitigation measures are moving from short-term emergency responses to longer-term sustained approaches. There is an improved understanding of the social, cultural, gender and economic consequences of both the disease and the interventions. Much has been learned about vaccination strategies and compensation policies for more strategic and context specific approaches with greater collaboration between public and private sectors, and communities.

There has been significant progress with strengthening healthy poultry production and vigilance in affected countries, as evidenced by the substantial decline in the number of countries affected by H5N1 HPAI since 2006. Surveillance has improved in most countries, though improved risk analysis (epidemiological capacity) and stronger engagement with the private sector is still required. Other critical areas for improvement include strengthened laboratory capacity, further building of laboratory and epidemiology networks, strengthening often outdated and inadequate veterinary legislation, and strengthening biosecurity levels across the entire poultry production and market chains.

It is unrealistic to expect that influenza A viruses will ever be eradicated due to the highly diverse gene pool circulating in wild bird reservoirs, humans, and a range of other animals including domestic and agricultural species. However, it is possible to eliminate H5N1 HPAI disease in intensive poultry production and reduce its prevalence in domestic and small industry settings. Sustainable progressive control of the disease is recommended which incorporates risk assessment of introduction and potential pathways for the disease, an understanding of poultry production and market chains, effective surveillance systems supported by competent laboratories for early detection, rapid response capabilities, public-private partnerships and strong veterinary services.

Progressive prevention and control measures are somewhat different from the emergency management focused approaches undertaken to date. There is a greater focus on stepwise evaluative approaches with long-term planning and sustainability, as well as political and industry commitments supported by adequate resources. Progressive control is based on the application of multidisciplinary expertise, a better understanding of socio-economic impacts and gender analysis, as well as consideration of opportunities and barriers for technical options through greater engagement of all stakeholders.

H5N1 HPAI limits healthy poultry production and impacts the livelihoods of millions of people. The risk of emergent severe pandemic influenza remains.

Key actions for countries with endemic H5N1 HPAI include long term structural and systemic changes to minimize the risks of H5N1 (and other diseases). Broader partnerships need to be established which include the entire poultry value chain, local communities, community based prevention and control, and engagement of health authorities. In non-endemic settings, a focus on market-based risk reduction strategies and awareness, vigilance and surveillance is required. In both settings, a shift from emergency communication campaigns to longer-term communication approaches is needed, requiring investments in communication capacities and competencies for animal health and other sectors. The benefits extend to a better understanding of disease drivers, and long-lasting investments to maintain healthy livestock and address other animal diseases of importance such as brucellosis and rabies, or food-borne diseases such as salmonella.

One of the major barriers to progressive control of H5N1 HPAI is weak veterinary systems. Veterinary systems are essential to support the prevention, early identification and control of diseases, associated with a clear need for improved synergies between public health, agriculture food production/farming and economic development. Long term communication interventions promoting appropriate bio-security and encouraging community-based reporting, improved analysis of gender and socio-cultural determinants, as well as multi-disciplinary research are needed to ensure that the complexity and multi-factorial nature of emerging infectious diseases are fully understood and addressed.

2.1 Detailed update of global H5N1 HPAI situation

2.1.1 Countries with continuing circulation of H5N1 HPAI in domestic poultry (2009-2010)

In **Bangladesh** H5N1 highly pathogenic avian influenza (HPAI) is believed to be endemic with active circulation of the virus. During 2009, 32 outbreaks were reported and some 100 000 birds were culled (See figure 2-1). This compares to 227 outbreaks reported during 2008. Active surveillance is currently being conducted in 150 sub-districts across the country, including the innovative use of the Short Message Service (SMS) gateway. Vaccination is currently prohibited.

During 2009, **Indonesia** continued to report a high number of H5N1 HPAI outbreaks in poultry, as it had for the past years. HPAI is confirmed to be endemic on the islands of Java, Sumatra and Sulawesi, and probably Bali, with sporadic outbreaks reported elsewhere in almost all of its 33 provinces. The high number of reports is partially explained by the implementation of the Participatory Disease Surveillance and Response (PDSR) program that targets village poultry production systems (mainly backyard).

In **Viet Nam**, during 2009, 53 H5N1 HPAI outbreaks were reported in 18 of 63 provinces (29 percent), mostly on duck farms (88 percent) and in the small-scale commercial sector (73 percent of outbreaks in flocks with 50 to 1 000 birds). This compares to eight outbreaks reported in 2008 (See figure 2-2). Surveillance was carried out in 16 target provinces and cities. However, outbreak investigations are not routinely undertaken on infected farms and it is difficult to understand the way the virus is spreading.

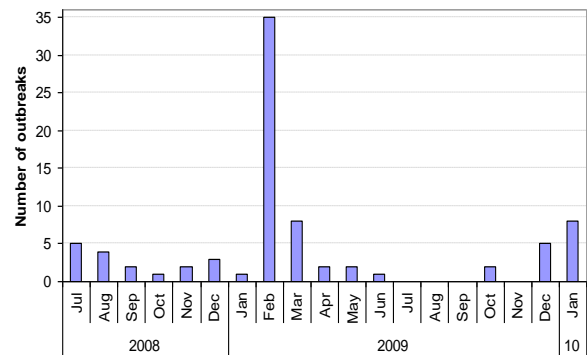


FIGURE 2-1: H5N1 HPAI OUTBREAKS IN BANGLADESH (SOURCE: FAO EMPRES-I)

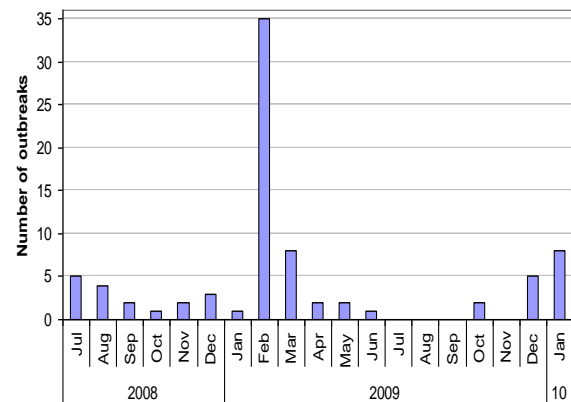
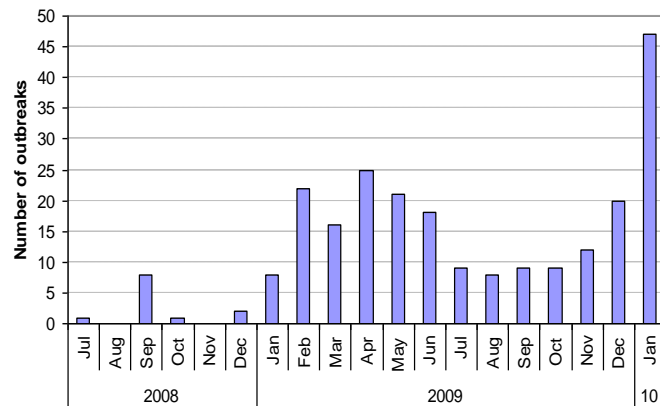


FIGURE 2-2: H5N1 HPAI OUTBREAKS IN VIET NAM (SOURCE: FAO EMPRES-I)

Egypt, which reported its first H5N1 HPAI outbreak in February 2006, is considered enzootic with regular reporting of outbreaks in almost all of its 29 governorates. In 2009, 177 outbreaks were reported in poultry, mainly in backyard systems, as compared to 116 in 2008 (See figure 2-3). Detection has improved since the introduction of Community Animal Health Outreach (CAHO) programs in ten governorates.

FIGURE 2-3; H5N1 HPAI OUTBREAKS IN EGYPT
(SOURCE: FAO EMPRES-I)



In **China** the H5N1 virus remains active in several parts of the country, including in locations where it has not previously been detected since the onset of the epidemic in 2004. No poultry outbreaks have been reported since April 2009 and the last wild bird case dates from May 2009. However, official surveillance programs suggest that H5N1 HPAI viruses continue to circulate in poultry in many provinces.

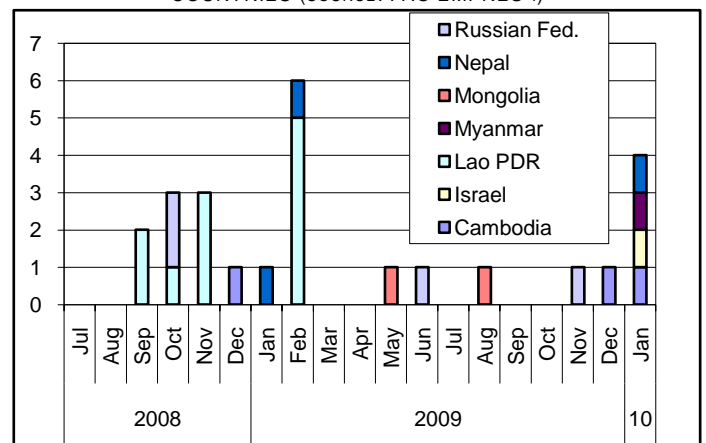
2.1.2 The H5N1 HPAI situation in domestic poultry in other countries (2009-2010)

During December 2008 and 2009, **Cambodia** reported one single human H5N1 case following a die-off in backyard poultry. In January 2010, Cambodia confirmed H5N1 HPAI outbreaks in ducks in Takeo Province.

In January 2010, **Myanmar** reported an H5N1 HPAI outbreak in commercial layers in Yangon Municipal Area; the last official outbreak had been reported in December 2007. It is possible that virus circulation in village poultry goes in part unnoticed.

Lao People's Democratic Republic reported five H5N1 HPAI outbreaks in 2009, in Phongsaly Province which had never been infected before. This compares to 13 poultry outbreaks reported in 2008.

FIGURE 2-4; H5N1 HPAI OUTBREAKS IN NON-ENDEMIC COUNTRIES (SOURCE: FAO EMPRES-I)



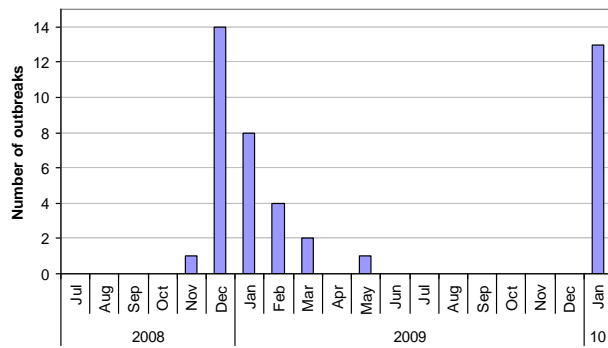


FIGURE 2-5: H5N1 HPAI OUTBREAKS IN INDIA
(SOURCE: FAO EMPRES-I)

During 2009 **India** experienced multiple outbreaks in poultry, mainly in the West Bengal area. India controls poultry infections with much rigor as it pursues an H5N1 freedom status (Figure 2-5).

In January and February 2009, **Nepal** reported its first two H5N1 HPAI outbreaks, in backyard poultry in, the south-eastern part of the country. A new HPAI outbreak was confirmed in January 2010.

In May 2009, **Mongolia** reported two wild bird outbreaks. In **Russia**, in the Ovursky District (bordering Mongolia), 58 great crested grebes were found infected with H5N1 AI virus in June 2009. A rock dove was found sick with H5N1 in October 2009, in Moskovskaya Oblast, possibly related to the westwards seasonal migration of migratory waterfowl.

In January 2010, **Israel** confirmed an H5N1 HPAI outbreak in a commercial breeder farm in Haifa Province. The source of infection is believed to be wild birds. The previous H5N1 outbreak in Israel dates from January 2008 pet-bird holding near to the current outbreak. **Nigeria** did not report any outbreaks in 2009 despite active surveillance.

2.1.3 The H5N1 HPAI situation in wild birds (2009-2010)

Whilst the spread and transmission of H5N1 HPAI mostly relates to poultry production and trade, wild bird cases of H5N1 are expected to periodically occur. When H5N1 HPAI emerged in poultry, wild birds as known carriers of H5N1 and other influenza viruses were quickly blamed for the dissemination of the virus. To better understand the role of these species in the H5N1 HPAI outbreaks in poultry programs and to support global wildlife disease surveillance, movement studies on wild bird populations were initiated. Utilizing satellite telemetry, this work demonstrated a direct link between H5N1 endemic areas in Bangladesh and India and deaths of wild birds in China and Mongolia. Wild birds can carry the H5N1 virus over long distances and across borders.

The overall incidence of H5N1 in wild birds slightly decreased in 2009, with 12 outbreaks or events reported (as compared to 23 in 2008) affecting Germany, Russia, Mongolia and China/HK. Compared with domestic poultry populations, infection in wild birds affects a restricted number of birds (see figure 2-6).

While this decrease is not very significant (given the presumed high number of unreported outbreaks in wild birds) none of the outbreaks were on the scale of thousands of wild birds as in spring and summer of 2005 in China and Russia.

Since 2004, over 90 species from 14 orders of bird have tested positive for H5N1. Surveillance systems are very strong in Hong Kong, and a high proportion of H5N1 birds are reported from Hong Kong SAR. It is likely that clade 2.3.2 viruses have become established in wild birds, posing a threat to poultry in areas where wild birds and poultry enter into contact.

2.1.4 H5N1 HPAI in other animal species`

Various research studies have investigated transmission of H5N1 HPAI in other animals including in domestic cats, tigers and leopards (felids) noting the extended host range of this virus. H5N1 virus is more virulent for felids than other influenza viruses¹. In Indonesia, studies have shown a seroprevalence of H5 neutralizing antibodies of up to 20% in the cat population living near poultry markets where H5N1 virus has been circulating².

There is no evidence to suggest that H5N1 AI viruses are adapted to swine although there have been isolated incidents in which pigs were found to be positive. H9N2 avian influenza viruses have been detected frequently in pigs in China and theoretically pose as much of a threat to humans as H5N1 AI viruses, and have already adapted to infect a mammalian

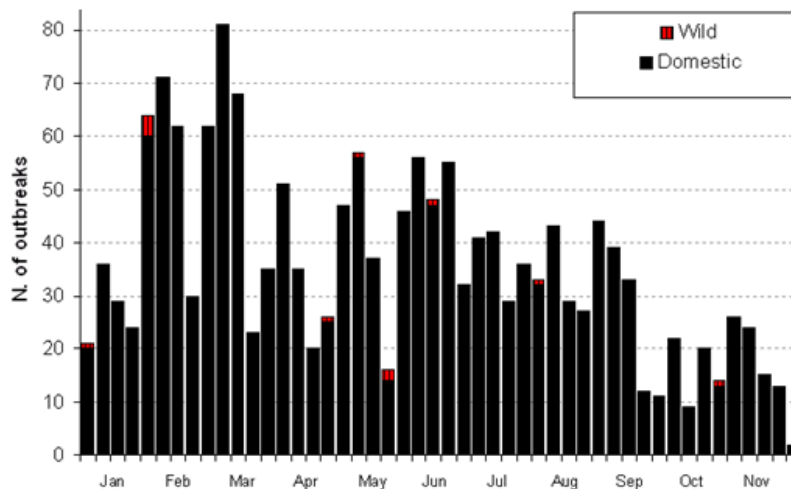


Figure 2-6 - Number of H5N1 outbreaks in domestic poultry and wild birds over 2009

Source: FAO EMPRES-1

host³. Cases of HPAI infection have been recorded in several other animal species, both naturally and experimentally, including laboratory mice, ferrets, civet, stone marten and dogs.⁴

The expanded host range of H5N1 AI virus into felids in particular, has implications for wildlife conservation and influenza virus epidemiology and may threaten the survival of endangered felids, as has

been shown recently for other emerging viruses in susceptible wildlife. The severity of this threat is increased because H5N1 virus may be transmitted horizontally between domestic cats. The role of felids in avian influenza epidemiology, both in humans and in poultry, may need to be re-evaluated. Finally, the confirmation of H5N1 virus infection as the probable cause of death in two other mammalian hosts besides humans implies that more species of mammals may be at risk for infection with this virus⁵.

2.1.5 The H5N1 AI virus situation in humans (2009-2010)

Decreasing virus circulation in poultry is the most important step towards decreasing risk in humans. Although relatively rare, human cases are more common in countries with poultry outbreaks. According to recent dataⁱ, 95 percent of total human cases worldwide have been reported in the five most affected H5N1 AI virus enzootic countries (Bangladesh, Egypt, Indonesia, Vietnam and China). As noted in Paper 1 (1.1.2) all human cases have occurred in countries with ongoing circulation or reintroduction of H5N1 viruses in poultry.

Figure 2-7 shows that **no new countries recorded human cases of avian influenza H5N1 infection in 2009**, representing a steady decline in the number of new countries recording human cases since 2006.

An analysis of detection times for poultry H5N1 outbreaks⁶ shows a 61 percent decrease in the number of days from event start to laboratory confirmation of H5 or H5N1 virus between 2005 and 2009.

The speed of detecting human infections in most affected countries has remained unchanged. The average time between symptom onset and hospitalisation for human cases is approximately 5-6 days. This timeframe decreased in Egypt to approximately 2.5 days in 2009, though the average time so far in 2010 is much higher (see figure 2.8)⁷.

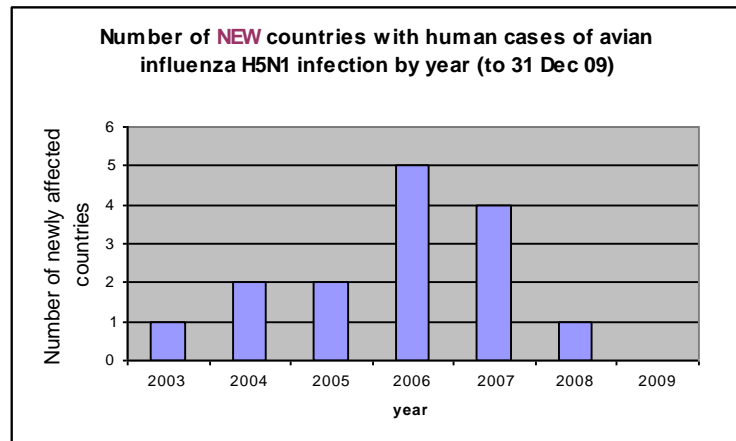
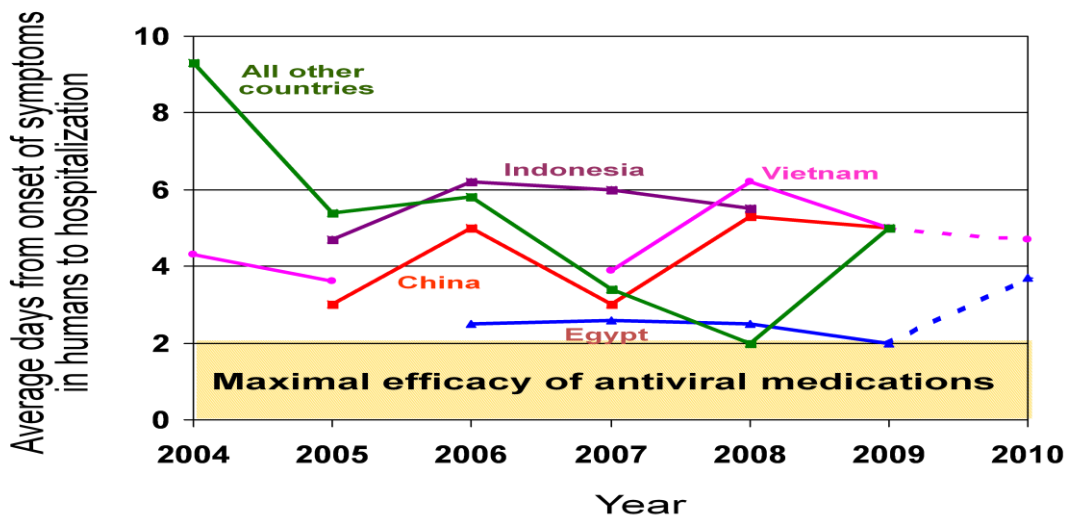


Figure 2-7: Number of new countries with human cases of avian influenza H5N1
Source: WHO

ⁱ USAID analysis based on WHO, OIE reports to February 2010; data includes estimates of human cases in Indonesia for January-July 2009 since official reporting to WHO was not available after December 2008.

Figure 2-8: Speed of detecting* Human Infections in Affected Countries

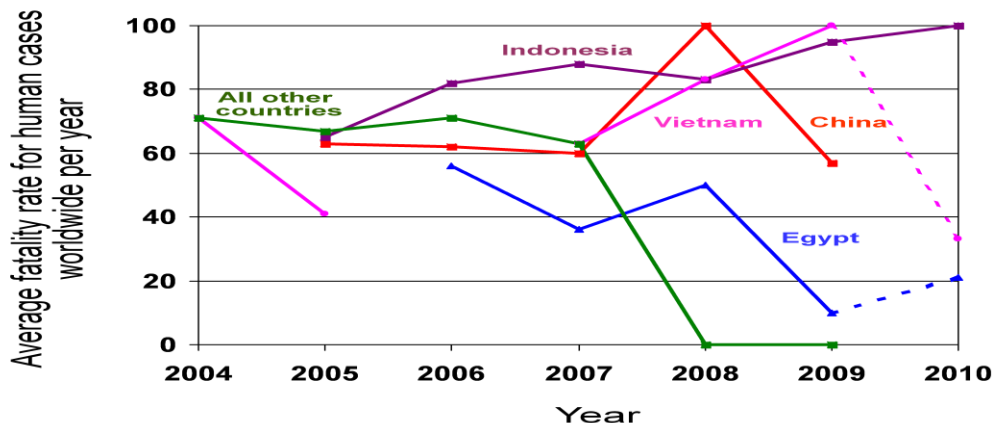


*Note: Based on WHO reports; since most samples are collected when suspect cases are hospitalised, it is presumed that time between symptom onset and hospitalisation is roughly equivalent to time between symptom onset and “detection”. Cases may present to other health care facilities prior to being hospitalised.
Source: USAID

In most countries with H5N1 AI virus human cases, average CFRs have remained above 60 percent. In Egypt, average case fatality rates have significantly declined over time to 10 percent in 2009 (See figure 2-9). This seems to be associated with faster access to treatment including oseltamivir. Approximately 73 percent of fatal cases have been reported in women over the age of 15 years, with indications that this group has been slower to report to hospital for medical treatment than other for males or other age groups⁸.

In summary, strengthened human disease surveillance and reporting is still required in most affected countries. In addition, the detection time for human cases needs to be reduced to produce further reductions in CFRs.

Figure 2-9: Progress with lowering human Case Fatality Rate



Source: USAID, based on WHO reports to March 2010.

2.1.6 H5N1 Virus evolution

H5N1 has been around since before the industrialization of the poultry sector, however, it was first described in the late 19th century. There are known incidences of outbreaks spreading through the movement of poultry as early as 1901. While the origins of these early viruses are not known, it is believed that H5N1 was endemic in parts of central Europe and Egypt in the 19th and 20th centuries, suggesting that outbreaks were not readily contained thus facilitating mutation from low to high virulence⁹.

Influenza viruses continually change through mutation and exchange (reassortment) of genes in ways we do not understand. Evolutionary changes in the H5N1 viruses circulating globally have already been noted, however, there is as yet no indication that these changes have impacted the epidemiology of the disease in animals or humans. There is an ongoing risk that the virus could mutate further and become an increased concern to either animal health or human health or both. The likelihood of this change remains essentially the same as it has been over the past years.

Currently, there are two different groups of H5N1 viruses circulating among poultry (clade 1 and clade 2 viruses) and at least three subgroups of the clade 2 H5N1 viruses have infected humans to date. While H5N1 virus infections of humans continue to be rare, most cases have been associated with direct poultry contact during poultry outbreaks.

There is also concern that circulating H5N1 AI or other viruses in animals could reassort with concurrently circulating viruses such as the current Pandemic (H1N1) 2009 virus. Influenza viruses mutate constantly and vigilance should remain high. Of continued concern is the risk of the H5N1 virus developing the characteristics, either through reassortment or through mutation, to start an influenza pandemic (it currently only lacks the ability to spread efficiently and sustainably among humans). Given that few people have been infected by H5N1, an H5N1 AI pandemic is a concern as there is limited natural protection against the virus in human populations.

2.2 Progress to date with H5N1 control

2.2.1 Management of H5N1 mitigation efforts in endemic countries

Efforts to mitigate H5N1 disease impacts have been centred around early reporting, surveillance, laboratory networks, vaccination strategies, epidemiological analysis and biosecurity enhancement. Approaches are customised to the particular disease status and risks of individual countries. Several countries are currently adapting mitigation strategies with a focus on longer term sustainable approaches. Some of the major policy shifts have been related to a more judicious consideration of the role of poultry in rural life, and thus, the often deleterious impacts that culling has had on rural livelihoods. Increased awareness of the multiple inter-related factors contributing to the emergence of diseases has highlighted the importance of both public and private animal health systems for disease mitigation and control efforts.

Vaccination Strategies

Much has been learned about poultry vaccination strategies since the H5N1 HPAI outbreaks began in 2003. While a number of commercial vaccines have the potential to reduce the level of circulating virus in poultry flocks, there are a number of challenges that impact vaccination strategies. For instance, in order to achieve significant reductions in circulating virus, a sufficiently high vaccination coverage level should be reached (50% to 90% immunization of at least 50% of all flocks at risk of infection) with a vaccine that protects against most circulating virus(es). This proves difficult for technical, logistical and cost related reasons, and calls for careful targeting of vaccination spatially, temporally, and / or by production system to maximise its impact and cost-effectiveness. Effective targeting, however, requires sound risk assessments, for which data and expertise are often lacking. Strengthening of the epidemiological capacity of national animal health systems is a major prerequisite for large-scale use of vaccination in the control of HPAI (See Case Study 2-1: Gathering Evidence for a Transitional Strategy in Vietnam).

Case Study 2-1 - Gathering Evidence for a Transitional Strategy (GETS) for HPAI H5N1 Vaccination in Viet Nam

Viet Nam has been practicing mass vaccination of poultry twice a year (October and April) since autumn of year 2005 to control epidemic H5N1 HPAI with some considerable empirical evidence of success. However, it has been recognised that this control strategy is not sustainable over the whole country in the long term. Mass vaccination entails a large amount of financial resources from the government and ties up significant human resources in the agriculture sector.

The GETS project has been established to assist the Government of Viet Nam in transitioning from mass vaccination of poultry to more cost effective and targeted measures for sustained control of HPAI in five high and low risk provinces. The project uses a multidisciplinary approach to gather data consisting of a vaccine strategic intervention that incorporates public awareness, training and surveillance field activities, a cost effectiveness component, a sociological behavioural component and a policy analysis component. The results of the field data will be provided to the Ministry of Agriculture & Rural Development of Vietnam to assist them in their choice of future vaccination strategy for HPAI.

Source: FAO

Compensation Policies

Progress in compensation has been guided by a renewed interest by countries after the initial push for developing compensation policies. The interest has been divided into four specific aspects:

1. Processes for integrating the compensation strategy within legal frameworks.
2. Development of specific Standard Operating Procedures to support the compensation strategy when implemented
3. Development of sustainable compensation funds
4. Understanding the linkages between disease control (culling, safe disposal and disinfection) and compensation and the ability to source financing.

Using a general framework and guiding principles of compensation, some work has begun in some countries to develop policies that are **context specific**. This has been done through consultation with a variety of stakeholders including legal experts, the private sector, public sector ministries. Initial strategies have been developed for ministries of livestock/agriculture to support and guide through the legal process.

To date some of the main lessons learned on the success of compensation have been: the need for transparency, the importance of delinking disbursement and auditing, and the relationship between compensation and increased reporting, and the need to harmonize compensation across borders to prevent animal (and thus disease) movement.

Cross border cooperation

Previous and more recent experiences of emerging infectious diseases across borders with far reaching regional and global impacts, such as SARS, HPAI, Nipah virus, and dengue fever, have stimulated cross-border work and sub-regional and regional coordination. Given the transboundary nature of many of these diseases such actions can support improved reporting, surveillance and laboratory networks, epidemiological analyses and response systems, health support and lead to a better utilisation of pharmaceutical products¹⁰. Such networks can be supported by political regional institutions like ASEAN and technically by the UN specialized agencies such as WHO and FAO, as well as international partners such as USAID and Rockefeller Foundation.

An example of cross-border collaboration is the Mekong Basin Disease Surveillance Network (MBDS) which was established in 1999 among six countries: Cambodia, Yunnan province of China, Lao PDR, Myanmar, Vietnam, and Thailand. The network aims to encourage sharing of information and biological materials on disease outbreaks and to develop the capacity to respond effectively. These efforts will strengthen national and sub-regional capabilities in infectious disease surveillance and outbreak response for priority diseases (consistent with IHR 2005). Cross border collaboration is being established in other regions as well, including in the Mediterranean Basin (See Case Study 2-2).

Case Study 2-2: Regional and international organizations partnering to improve the surveillance of transboundary animal diseases in the Mediterranean Basin

Starting in October 2007 the FAO/ECTAD Unit of the FAO/OIE RAHC-NA (Regional Animal Health Center-North Africa) established a series of regional coordination mechanisms out of which the twice-a-year regional coordination meetings became a main event for cross-border discussion and information exchange between the veterinary services of the region.

During the Second Regional Coordination Meeting hosted by the Spanish Ministry of Agriculture in Avila in 2008, the participants from North Africa and South Europe welcomed the initiative launched by FAO/OIE RAHC-NA to establish a Mediterranean Euro-Maghreb Animal Health Network (MAHN in English or REMESA in French/Spanish). This network would promote the cross-border cooperation in animal health by facilitating the coordination of the strategies for the prevention and control of transboundary animal diseases, the joint efforts to strengthen the capacities of the veterinary services, the sharing of experiences and the regular exchange of information on the zoo-sanitary situation. The network would also facilitate access to information concerning the ongoing animal health projects/activities in the region and the available regional resources for disease prevention and control.

The REMESA annual Action Plan for 2010 has taken into consideration all existing past and present animal health experiences and ongoing programmes in the region (bilateral cooperation among countries, regional projects, and previous experiences in order to avoid duplications). The action plan also links and enhances the already existing FAO, OIE and WHO global programmes, networks, systems for Transboundary Animal Diseases control such as Emergency Prevention Systems, Global Early Warning System for Major Animal Diseases, including Zoonoses (GLEWS), OIE/FAO Network of Expertise on Animal Influenza (OFFLU), etc, as well as the animal health networking activities developed by European Union and the bilateral projects funded by Spain, Italy, France and others.

Source: FAO/OIE

2.2.2 Progress with strengthening healthy poultry production and vigilance in all countries

Surveillance Capacity

Results from a recent FAO country surveyⁱⁱ show that most countries have improved their surveillance capacity. As of December 2009, all countries surveyed had at least ‘fair’ surveillance capacity and 70 percent had a ‘good’ to ‘excellent’ capacity. Significant progress has been made in terms of human resources (availability and training), funding (still predominantly from external sources), which has translated into efficient, active and passive surveillance in 95 percent of the countries.

However, further improvement can still be achieved. Notably, surveillance plans have three major weaknesses in terms of design: (i) they are not based on strong risk analysis (due to a lack of epidemiology capacity); (ii) engagement with the private sector is limited (poultry producers and private veterinarians); and (iii) insufficient surveillance is carried out at the domestic poultry/wild bird interface.

Laboratory diagnostics

Many developing countries have minimal funding available for laboratory maintenance of measurement and bio-safety equipment, or access to maintenance and calibration service companies. Further ongoing training of existing and new staff may not always be possible. Laboratories need to be better integrated into overall animal disease prevention and control strategy and activities. This could be achieved through links between outbreak and virus information; contributions to molecular epidemiology studies; adapting laboratory detection to surveillance needs and vaccination context; monitoring vaccine efficacy, sharing virological material with the international community; and by developing international and regional collaborations on influenza viruses. Regional laboratory networks can facilitate laboratory capacity building, coordination of regional activities and catalysing regional collaborations (See Case Study 2-3: The West and Central Africa Laboratory Network).

ⁱⁱ FAO conducted a field survey in November 2009 which aimed to assess national capacities to prevent and control H5N1 and monitor progress made over the reporting period. The survey was completed by FAO staff positioned in countries and therefore does not necessarily reflect views from other agencies or the governments. 34 countries were included in the survey from Sub-Saharan Africa, South and South East Asia, Central Asia, North Africa and the Middle-East, Eastern Europe and the Caucasus.

Case Study 2- 3: RESOLAB, the West and Central Africa Laboratory Network

The West and Central African Veterinary Laboratory Network for Avian Influenza and other Transboundary Disease (RESOLAB) was created by FAO in December 2007 and put under the coordination of the regional office of FAO - Emergency Centre for Transboundary Animal Diseases (ECTAD) at the OIE/FAO/AU Regional Animal Health Centre in Bamako, Mali. Its immediate objectives are to enhance the effectiveness and efficiency of the 23 national veterinary diagnostic laboratories of Western and Central Africa, improve communication between them and national and regional epidemiological networks and stimulate improvement of avian influenza (AI) expertise and quality of laboratory diagnosis of animal diseases within the region. RESOLAB is technically supported by the Istituto Zooprofilattico Sperimentale delle Venezie (IZSV) of Padova - (OIE)/FAO reference laboratory for AI/ND (Newcastle Disease) - and institutions such as United States Department of Agriculture/Animal and Plant Health Inspection Service, the French Agricultural Research Center for International Development and the US Centers for Disease Control and Prevention.

Since its creation, the RESOLAB has organized the training of more than 200 laboratory technicians, including at IZSVe. So far, 15 out of the 23 laboratories in the region have undergone rapid assessment exercises. Renovation of laboratory facilities has been carried out in three laboratories. Reagents for AI testing as well as autopsy kits, sampling materials, and shipping boxes have been provided to all 23 laboratories of the region. Two rounds of proficiency tests, under the umbrella of IZSVe have been carried out in 2008 and 2009 that involved all member laboratories.

To improve information exchanges, a website was developed that includes primary data and information (<http://www.fao-ectad-bamako.org/>), in addition to the collection and dissemination of technical information through an e-mailing list. Technical papers have been published, and annual coordination meetings held. The consolidation and sustainability of RESOLAB will depend on the recognition of its capacity to significantly contribute to the improvement of the diagnostic capacity of national veterinary laboratories, and on the support of Member States and their regional economic organizations. Thus, RESOLAB is a good example of international cooperation to improve diagnostics for better response to EIDs.

Source: FAO

The three countries that currently implement H5N1 AI vaccination on a wide scale (Egypt, Indonesia and Viet Nam) have the capacity to monitor the serological vaccination response with FAO support for provision of equipment, reinforcement of human resources and allocation of funds.

All African countries surveyed by FAO and, to a lesser extent Asia, are part of a sub-regional veterinary laboratory networks with very positive results, but this is not yet in place for Eastern Europe and Central Asian countries. The level of networking and sharing of information, especially through regional laboratory networks, has continued to increase along with the overall technical capacities of laboratories in the last two years.

Challenges remain however, and there is persistent turnover of laboratory personnel and an absence of training in laboratory topics. Implementation of “Good Laboratory Practices and Quality Assurance,” including participation to annual or bi-annual proficiency tests, are priorities for most veterinary national laboratories in the coming years.

Veterinary Legislation

Veterinary legislation and proper governance are essential elements of the national infrastructure that enables Veterinary Authorities to carry out their key functions, including surveillance, early detection and control of animal diseases and zoonoses, animal production food safety and certification of animals and animal products for export. In the face of increasing global trade, climate change and the emergence and reemergence of diseases that can rapidly spread across international borders, veterinary services must be effectively supported by legislation to meet the OIE criteria for performance of essential functions.

In many developing countries veterinary legislation is outdated and inadequate to address the challenges of today and of the future. Legislation and governance have been, or are being, developed and modernized in a range of countries to support animal health generally or H5N1 prevention and control in particular with support from OIE and FAO (for example, through the publication of OIE legislative guidelines and FAO and OIE missions to countries). However there is still a considerable way to go in implementing sound legislative, governance and compliance systems in many countries.

Biosecurity Measures

Very few countries have established biosecurity measures since 2008 and the global level of biosecurity in the poultry chain remains low. In 52 percent of FAO-surveyed countries, there are no biosecurity measures at all in sectors 3 and 4, and when they do exist, the resulting level of biosecurity was rated poor or very poor in 67 percent of the countries. On the other hand, in sectors 1 and 2, efficient measures are implemented in 80 percent of countries surveyedⁱⁱⁱ. Live bird markets received very little attention in terms of biosecurity, with no measures implemented in 51 percent of countries surveyed. All sectors included, Africa seems to be the region where most efforts have occurred for biosecurity.

Major constraints for instituting biosecurity measures include (i) in most countries there is neither a legal/regulatory act on biosecurity nor a mandatory poultry farm registration system in place, and therefore measures cannot be enforced; (ii) incentives to implement biosecurity measures are non-existent, such as, a compensation system; on the contrary, the price and constraints for implementing biosecurity on a daily basis is regarded as a disincentive; and (iii) the level of awareness of the benefit of such measures is low, notably in sectors 3 and 4. However, national biosecurity campaigns have recently been conducted with limited effects to date in most developing countries. FAO's support to the implementation of biosecurity measures at the country level has been limited to date; though FAO Guidelines have been recently produced and should support implementation of better practices on farms and at markets.

2.3 Progressive control of H5N1 in countries

2.3.1 Is eradication possible?

Eradication of Influenza A viruses is not possible given the highly diverse gene pool of viruses circulating in wild water-bird reservoirs, human populations, and a range of other animals including domestic, agricultural, wild and marine species. However, given the risks AI viruses pose to human health and poultry production, it is both highly desirable and feasible to achieve elimination and control of H5N1 in domestic poultry production. This would reduce the incidence of H5N1 HPAI in areas where animal husbandry systems do not readily permit biosecurity separation between wildlife, poultry and domestic waterfowl production, such as rice-duck agriculture (See Case Study 2-4: H5N1 persistence and rice-duck agriculture in Asia).

Case Study 2-4: H5N1 persistence and rice-duck agriculture in Asia

The persistence of H5N1 HPAI virus in Asia is in part linked to river deltas, plains or other wetland areas with irrigated rice production and high densities of domestic ducks. In Asia, ducks are often kept in rice paddies to feed on left-over rice grains immediately after the harvest. In some areas, ducklings are released also during the early stage of the rice growing cycle. Ducks also aid the control of the golden apple snail, a local pest problem.

With most of the rice cropping taking place after the monsoon rains, most duck meat production occurs during the late autumn and early winter months. In Southeast Asia, meat duck production typically peaks during the month of January, just prior to the Chinese New Year. Given that layer ducks require year-round availability of feed in order to maintain the egg production, layer production is mostly confined to the irrigated rice cropping areas where there is always some harvesting taking place.

Ducks flocks are continually rotated in accordance with the local harvest distribution. Duck egg production is mostly confined to areas such as river deltas and plains, where the local hydrology and irrigation support rice crop cycles are outside the monsoon season. Most of the meat production takes place in these same areas because meat ducklings are released in large numbers and this requires a good local supply of eggs for hatching. Rice-duck agriculture is important in Bangladesh, China, Indonesia and VietNam; all of which are H5N1 enzootic countries.

Source: FAO

Most of the world's domestic duck congregations, particularly in Asia, present a permanent source of H5N1 viruses. Commercial broiler production, distribution and marketing facilitate H5N1 HPAI virus spread. Vaccination in ducks and chicken suppresses disease signs (but does not eliminate virus circulation in all cases). Providing necessary control measures and reducing incidence of the disease will not of itself result in eradication. The control systems for H5N1 in endemic situations needs long term sustainable efforts and national leadership and community-industry-public sector cooperation and coordination.

2.3.2 Key elements of sustainable progressive control

The nature of control systems for H5N1 HPAI is similar in countries whether outbreaks are isolated, extensive or endemic in nature, but can differ in terms of intensity and duration of effort. The development and implementation of agreed strategies provides a common vision and approach for progressive control which can be amended in the light of experience.

Key considerations include assessing the risk of introduction and potential pathways for the disease; an understanding of poultry production and market chains; effective surveillance systems supported by competent laboratories for early detection; a capacity and authority to manage rapid response actions; and skills in epidemiological investigation to understand the progress of the disease and effectiveness of measures.

Community support and engagement is essential to support early detection and control of the disease and matters of compensation and economic adjustments should be agreed and clearly understood. Therefore, ongoing awareness and communications strategies are critical success factors. In addition, private/public partnerships help to set standards and roles and responsibilities in the commercial sector, and engender overall support for programmes. Political support, leadership and the provision of adequate resources are necessary if control measures are to succeed.

In countries where the virus remains endemic, communication for behaviour and social change has been instrumental in promoting the adoption of some critical protective behaviours to contain avian influenza. However, important gaps remain, such as selective adoption of recommended protective practices by the population; lack of sustainability and low compliance and public engagement with the control measures.

Strengthening of veterinary services is essential for the long term progressive control of disease and to support close engagement with public health authorities, relevant sectors of government, industry, communities and other stakeholders. The OIE/FAO Global Program for Strengthening Veterinary Governance utilises the OIE Performance of Veterinary Services (PVS) Pathway, includes evaluation and gap analysis components and provides comprehensive tools to enable countries to identify capacity requirements with a view to obtaining funding for priority needs (such as compliance with OIE international standards and guidelines). OIE is in the process of introducing more substantial elements focusing on improved collaboration between the Veterinary Services and public health. Figures 2-10 and 2-11 show that demand for veterinary services gap analysis continues (particularly in Africa), and that further work is still urgently required to strengthen veterinary services capacity in all regions across the world.

Figure 2-10: Continued Demand for Veterinary Service Evaluations (Source: OIE)

OIE Regions	OIE Members	Requests Received	PVS Missions Completed	Reports Available for Distribution to Donors and Partners
Africa	51	44	40	31
Americas	28	17	17	15
Asia and Pacific	31	16	13	10
Europe	53	12	12	7
Middle East	12	12	10	3
TOTAL	175	101	92	66

Figure 2-11: Continued Demand for PVS Gap Analysis (Source: OIE)

OIE Regions	OIE Members	PVS Gap Analysis Missions: Requests Received	PVS Gap Analysis Missions Completed
Africa	51	26	13
Americas	28	8	1
Asia and Pacific	31	9	1
Europe	53	5	3
Middle East	12	2	2
TOTAL	175	50	20

2.3.3 Endemic countries: sustained progressive control

H5N1 in endemic countries requires long term political and industry commitments supported by adequate resources and gradual cultural change. With the ongoing threat of pandemic influenza, there is global consensus that continuous circulation or progressive increases in zoonotic influenza A viruses of H5N1 viruses should be prevented in all domestic poultry. Early detection and response remains critical to the ongoing risk of potential novel re-assortment of viruses resulting from this collective evolution.

Key actions for sustained progressive control

Most endemic countries are currently in the process of reviewing their strategy for H5N1 control and prevention, jointly with the international animal and public health agencies, taking into account that the emergency phase is past and that a broadening of the approach is now required in order to define lasting solutions in the medium to long term:

Broader partnerships: The broadening of the approach entails a widening of the partnership and a more direct involvement of stakeholders beyond the core animal and public health authorities, in particular the private poultry sector;

Importance of collaboration between the animal and public health sectors: Reports of outbreaks of H5N1 in animals and humans tend to increase simultaneously, and it is also notable that all human cases of H5N1 infection have occurred in countries with ongoing circulation or reintroduction of H5N1 viruses in poultry. Better management of poultry outbreaks in most countries has generally led to decreased virus circulation and a decreased risk for human exposure; overall there has been a progressive decline in the numbers of confirmed human infections globally since 2005-06. As such it is clear that close collaboration between human and public health sectors remains critical. This would include the strengthening of human and animal influenza surveillance to enable the timely detection of epidemiological, clinical, and virological changes, as well as the rapid sharing of information for quick and comprehensive assessments and global responses.

Focus on distribution and marketing of live poultry: The broadening of the approach extends to the entire poultry value chain, with due emphasis on distribution and marketing of live poultry including across country boundaries;

Direct involvement of local communities, district officers and farmers opens the door to customizing poultry husbandry practices in viable and sustainable ways, exploring local solutions tailored to the different sets of circumstances and engaging in planning and awareness activities;

Control and prevention will have to become more fully decentralized in order to enable communities, municipalities, producer associations, vendors and all others in the poultry chain to progressively take direct responsibility for H5N1 elimination;

The critical role of health authorities to monitor the progression in disease containment and elimination of disease and virus circulation remains high as the need for coordination and the orchestration of surveillance and lab activities increases;

As strong public engagement is critical for the success of containment efforts, community-based initiatives that promote dialogue and ensure feedback need to be implemented in order to build trust among the public, and the affected stakeholders in particular.

Medium to long term structural changes in the poultry subsector may extend to a re-organisation of live bird markets, with disaggregation of old and new forms of poultry chains and of certain types of poultry.

2.3.4 Non Endemic Countries: Sustained vigilance and improvements in healthy poultry production

In non-endemic areas that remain at risk, different approaches are needed for sustained vigilance. Some countries have expressed interest in implementing market-based risk reduction strategies, including appropriate monitoring and traceability systems that could be strategically used to improve market-access terms for the rural poor and to improve sanitary standards of production units. These approaches not only abate disease, but also alleviate poverty.

In non-endemic settings there is still a need to re-evaluate and improve the implementation of existing tools based on ongoing risk analysis along the poultry value chain. This process needs to go hand-in-hand with a clearer understanding of disease drivers coupled with long-lasting national investments that not only support H5N1 and H1N1 control efforts but also serve the purpose of maintaining healthy livestock and addressing other animal diseases of economic importance, among many other applications. It would be wrong, however, to limit our focus to influenza viruses with so many other diseases still looming and threatening the livelihoods of rural farmers worldwide. Diseases such as foot-and-mouth disease, African swine fever, Rift Valley fever, brucellosis, peste des petits ruminants and rabies continue to have major impacts on human health, livelihoods and food security.

In practice, where the disease burden is low, actions need to emphasize **awareness raising, vigilance and surveillance**. Actions should remain focused on prevention through good animal health services, hygienic production measures and community support (such as village health workers, trained people (See Case Study 2-5: Field Epidemiology Training Programme for Veterinarian programme in Asia); maintenance of good laboratory capacity and rapid access to reference laboratories, and contingency plans with regular conduct of simulation exercises. In addition, countries need to establish quarantine policies and a legal framework to support implementation and enforcement, as well as simple surveillance programmes to continue regular monitoring of potential disease niches and outbreaks.

Case Study 2-5: Field Epidemiology Training Programme for Veterinarians (FETPV)

The goal of the FETPV is to produce high quality graduates who are problem solvers and can provide science-based recommendations for government decision makers. A regional needs assessment identified key competencies and skills required by veterinary field epidemiologists. The training curriculum consists of interdisciplinary training modules including animal disease surveillance, outbreak investigation, data analysis, animal-human-environmental interface, geographic information systems, emergency preparedness and response and market chain analysis.

Since the initial level of training in epidemiology in various countries varies greatly, a one-month pre-requisite course is offered to narrow the gap among trainees from different countries. At least three trainees from the short course who best perform each year are invited to participate in the two-year FETPV programme that includes parallel training modules with medical doctors. With principles based on “training through providing services”, 75% of the trainees’ time is spent in their home country conducting field studies. During the two-year programme, trainees must complete one secondary data analysis, one field research project and four outbreak investigations as principle investigator. Field mentors play a critical role in providing trainees sound skills, and include skilled epidemiologists from FAO.

Regional FETPV is enlisting its second cohort of three international and three Thai trainees in June 2010. The pre-requisite short course and two-year programme are fully supported by Chief veterinary officers in 12 participating countries in Asia (Lao PDR, Cambodia, Myanmar, Nepal, Indonesia, India, Thailand, China, Mongolia, Vietnam, Malaysia, and the Philippines). India and China are currently developing satellite FETPV training nodes that will collaborate closely with Regional FETPV. The regional FETPV exemplifies the *One Health* approach, which promotes and integrates human, animal and environmental health, both conceptually and practically.

Source: FAO

2.3.5 Why Progressive Control of H5N1 is somewhat different from measures initially recommended

A key feature for progressive control of H5N1 is the development of **long-term planning and sustainability**. This requires national leadership and the broadening of partnerships, particularly the public and private sectors, as well as the development and implementation of agreed strategies featuring common visions and approaches which can be amended in the light of experience. Awareness raising, vigilance and surveillance are essential components of such plans.

It also entails **political and industry commitments, supported by adequate resources**. Ensuring sufficient financial resources may require countries to take innovative approaches to sourcing funding. For example, in Egypt a public-private partnership is being developed to look at the possibility of co-funding an emergency fund. In other places, such as several countries in West Africa, possibilities are being explored to develop the institutional arrangements for a fund that looks beyond avian influenza compensation to consider other diseases as well.

Efforts for the progressive control also take into account broader dimensions of HPAI, such as the **socio-economic impacts**. The poultry system is diverse with different products (broiler/layers/spent hens/eggs etc.) and different actors involved in poultry production and marketing. Poultry production is dynamic because the barriers to entering the value chain are small in developing and emerging economies and it has diverse production and marketing chains, which are often unregulated. People have very divergent drivers for being involved in poultry production, from a primary source of income to using it as an emergency source of cash or for cultural cohesion. Therefore, the impacts of the disease are widespread, from direct (on income from the loss of poultry) to indirect (downtime), from minor (a recurrent effect of Newcastle disease) to major (closure of a whole sector), and from tangible (income loss) to intangible (loss in poultry for social functions) resulting in the need to develop more nuanced approaches to HPAI control.

The concept of risk as determined by economic and social drivers provides better appreciation of the approaches needed and the role people can play and are playing in disease containment and control. Understanding the opportunities and barriers to adoption of technical options, such as vaccination, culling, and surveillance, can be provided to governments and farmers through cost benefit analysis and livelihood studies. However, prioritizing focus on more vulnerable populations has been challenging. Three main groups

are the most vulnerable to HPAI and control. Those are traditional extensive producers, semi-intensive producers, and other small-scale stakeholders. Few reports have documented the impact of HPAI and short and long-term prevention and control policies on those disadvantaged groups (See Case Study 2-6).

Case Study 2-6: Egypt H5N1 HPAI Joint United Nations assessment mission, December 2009

At the request of the Egyptian National Supreme Committee of Avian and Human Influenza, the UN Resident Coordinator Office in Cairo (UNRC) and UNSIC organized and facilitated a joint assessment mission by a multidisciplinary team from FAO, UNICEF, and WHO from 6-16 December 2009. The team was asked to review and assess the measures taken by all levels of the Government of Egypt to prevent and control outbreaks of H5N1 HPAI in poultry and people in Egypt, and to identify areas of concern and impediments to effective implementation.

The mission focused on reviewing strategies and mechanisms for the control of H5N1 HPAI in poultry and H5N1 infection in humans. Areas of concern and weakness were identified through the background reports and discussions with key programme managers and other stakeholders, and the team clarified these observations in-country and explored new strategies and mechanisms for controlling H5N1 influenza. In this way, the mission team was able to make clear operational recommendations that targeted mechanisms for multidisciplinary approaches, identifying opportunities for integration across disciplines and inclusion of affected communities in decision-making.

The immediate result of the mission was a comprehensive report on strengths and weaknesses of avian and human influenza control efforts in Egypt. The report stressed the impact of the changing epidemiology of H5N1 HPAI, which has evolved from distinct outbreaks to a widespread, enzootic disease. Specific recommendations addressed strengthening the National Supreme Committee of Avian and Human Influenza, and reinvigorating the national committees for animal health and communication. A meeting and workshop was organized by FAO in February 2010 to revise the national strategy and plan for controlling HPAI. Using the conclusions and recommendations of the joint-UN mission, the ministries of health, agriculture and environment and their partner NGOs will work together to build sustainable, interdisciplinary approaches to controlling endemic H5N1 influenza in Egypt.

Source: FAO

For successful longer term efforts, **gender** should also be factored into planning. Women are typically the main owners and managers of backyard poultry production. Amongst many poor households, where women's mobility, income earning opportunities and access to formal markets is restricted, poultry rearing is often amongst women's most important livelihood assets. This means that they and their families are more likely to suffer from loss of poultry and other HPAI-related impacts. With moves to intensive livestock production systems and improved processing arrangements, increasingly opportunities will arise for new forms of employment for both men and women which will require training and adaption to new social circumstances (See Case Study 2-7).

Case Study 2-7: Socio-economic impact of H5N1 HPAI in Egypt

The spread of the HPAI virus has had important socio-economic repercussions, resulting in a reduction in the consumption of poultry meat and eggs, especially by children¹. Poultry production is a substantial contributor to food supply in Egypt and plays a decisive role in food security and income of millions of Egyptians. Poultry is the major and often the only animal protein source in low income segment of the population. In addition, poultry keeping contribution to household income is very high (44.5% Geerlings et al 2008 - compared with other countries, 5% in Viet Nam, McLeod, 2007) and it is one of the essential income earning activities available to landless women.

In first wave of HPAI outbreaks, 30 million birds were culled causing USD2-3 billion loss and the livelihood of millions of Egyptian was affected. Poultry production and consumption dropped, and the rise in prices of most commodities, including poultry during the course of the disease, resulted in a large rise in the cost of all meats, milk and eggs. Currently the price of eggs, cheese and other dairy and animal protein products is far above the reach of a substantial percentage of Egyptian families. The poorer sectors of society are particularly at risk as the families frequently cannot compensate for the loss of poultry meat. HPAI and the accompanying control measures, especially massive and indiscriminate culling, contributed to the vulnerability of households to food insecurity.

Source: FAO

Taking into consideration all of the above knowledge (socio-economic aspects, a description of markets for different animal production and its products [milk and dairy, eggs, meat, bones, offal, crate disposal or disinfection]), **progressive control entails the mapping of progress using the 'discovered' critical points for intervention to improve the infection or disease status.** That is to say that there is a monitoring and feedback mechanism that will guide health authorities to either undertake additional measures or reinforce those that are being applied.

This stepwise evaluation of a country (or local) disease status based on criteria that ranges from endemic to sporadic to free, requires fine tuning of activities to be undertaken, such as “vaccination coverage over 50%; all events are investigated by health authorities and traceback studies conducted; central laboratory has a quality assurance scheme; tabletop simulation exercises conducted; live animal markets are registered ...” to, “...vaccination coverage over 75%; all events are investigated by joint animal and human health authorities and traceback studies conducted; central laboratory has a quality assurance scheme and participates in regional or international proficiency testing; field simulation exercises conducted with public and private sectors; integration of wildlife surveillance; epidemiology unit uses GIS mapping for analysis; poultry making schemes developed for all sectors and validated periodically; key markets in the capital are closed one day for cleaning and disinfection....”.

Progressive control, when commenced and conducted in an environment that promotes self-evaluation becomes robust as the vision and activities required become clearer to all stakeholders, and self-evaluation of the process assists in future planning to improve and reach the next step.

2.3.6 Why further work is needed

H5N1 HPAI remains a significant threat to human and animal health, both in terms of its direct effects (ie illness/death) and secondary impacts. For instance, HPAI can cause significant losses in the agricultural sector globally, and continue to jeopardise agricultural productivity, food security and the livelihoods of farmers (and by extension, transporters, marketers, etc) in some of the world's poorest countries.

With almost double the number of confirmed H5N1 cases in humans reported in 2009, compared with 2008, it is clear that H5N1 also remains a public health concern. As noted earlier in the report, all human cases of avian (H5N1) infection have occurred in countries with ongoing circulation or reintroduction of (H5N1) viruses in poultry.

A major reason that H5N1 AI virus remains a high priority is that it can cross over to humans and still has the potential to rapidly spread in human populations. Influenza viruses continually change through mutation and exchange (reassortment) of genes in unpredictable ways. Current scientific evidence suggests that new animal diseases will continue to emerge, and with this certainty in mind, governments need to factor in this evolving phenomenon into domestic and international policy development, especially those concerned with safeguarding the global commons of public health.

2.4 Barriers to progressive control of H5N1 and areas for greater focus

Continued and enhanced interagency and multisectoral collaboration

Whilst substantial progress has been made, further work is needed to strengthen commitment for management of high impact diseases arising at the animal-human interface. An environment of continued interagency and multisectoral collaboration and cooperation needs to be supported at the international level of the United Nations, in regional organizations, and national level institutions. At local levels participatory approaches need further support within the context of community cultural and social values and norms. In Papua New Guinea, for example, health care workers are trained to recognize sick poultry and how to take and transport a sample for testing. They are also trained in how to communicate the risks and the best response to the community.

Structures and systems still require substantial development

Systems and **structures required** (personnel, infrastructures, governance, legislation and policies) to prevent, detect and respond to the next pandemic or outbreak still need substantial development. **Veterinary systems are notably weak** in most countries around the globe in terms of governance, surveillance and diagnostic structures, quality education, and gainful employment and remuneration. Animal production and marketing do not have the regulatory history to ensure proper practices and hygiene in most countries, and especially in remote areas. The interface between human and veterinary medicine at the local level rarely occurs and at the Ministerial level it may be referenced but not practiced

and definitely not properly financed. The interface between natural resource management (including conservation and wildlife) and soil use and agriculture practices is an area of conflict, which requires common understanding and efforts for reconciliation.

Prevention systems are poorly funded at national and global level.

Should the idea of “tackling the disease at source” be held true, significant investment into disease intelligence, detection and early response is required. This includes robust systems for detection and reporting of events which may trigger disease spread or emergence. Donor support to regional and international agencies must develop a mid to long-term vision, and they should be balanced with the short-term emergency support that all too often requires inputs that do not **guarantee sustainability**, including capacity development in countries in need. Furthermore, the emphasis on a specific risk (i.e., H5N1 HPAI) in isolation of wider needs is short sighted for future emergency response and prevention measures. As a Public Good, the international community should continue to tackle the problem at source while assistance is also provided for local disease priorities (a two-pronged advocacy approach for health). A global approach is also required to reduce the substantial and widespread consequences of animal diseases, especially in today’s globalized and interconnected markets.

Several pivotal economic studies commissioned by OIE¹¹ on the prevention and control of animal diseases worldwide^{iv} and found that the **costs of preventing major animal diseases are significantly less than those associated with managing outbreaks** and the cost/benefit ratio of investing in prevention versus control is high. Thus supporting development of veterinary services in developing /in-transition countries remains a high priority. A subsequent OIE/EU/WB study on the Cost of National Prevention Systems for Animal Diseases and Zoonoses¹² December 2009^v found that variations in expenditures on prevention systems are clearly associated with differences in livestock population, and there is a close relationship between Gross Domestic Product (GDP) and the total public expenditures for the NPS.

Effective public-private partnerships

The private sector plays a pivotal role in complementing public sector responsibilities. Effective public-private partnerships remain a critical element for achievement of progressive control of zoonotic diseases at the animal-human interface, leveraging comparative strengths between government, industry groups, NGOs and academia. Further dialogue is needed to explore possible mechanisms for partnerships. One successful example is the not-for-profit organization Safe Supply of Affordable Food Everywhere, Inc (SSAFE). Initiatives are underway in Bangladesh, Egypt and Indonesia to improve public-private partnerships – see Case Study 2-8 for more details.

^{iv} : (i) International Conference co-organised by the World Bank (WB) and the World Organisation for Animal health (OIE) in collaboration with the Food and agriculture Organisation (FAO) of the United Nations: “Global Animal Health Initiative: The Way Forward”, held in Washington DC (USA), at the WB Headquarters on October 9-11, 2007.

^v This study was commissioned by the World Organisation for Animal Health (OIE) and co-funded by the World Bank and the European Union. The views and recommendations presented in this study are those of the authors and do not necessarily represent the views of the OIE or one of the co-funding institutions.

Cohesion of overarching policy goals

A major consideration for international, regional and national level management (including public-private sector dialogue) will be to strengthen the cohesion of overarching policy goals. At present there are strong disparities between the policy goals for public health, agriculture food production systems and sustainable farming approaches, and economic development. Synergies across common global public good goals would enable more effective outcomes.

Case Study 2-8: Public-Private Partnerships: A management tool for the prevention, detection and control of HPAI and other diseases

In Bangladesh, Egypt and Indonesia, where HPAI has become endemic, FAO has identified the need for the formation of functional and efficient animal health systems based on strategic partnerships. These collaborative mechanisms aim to improve the dialogue between the public and private sectors through the creation of a trusting and respectful environment to discuss and share ideas, focus on shared interests such as biosecurity, vaccination, compensation, diagnosis and identify mutual benefits such as food safety, food security and consumer confidence. These public private partnerships offer unique opportunities to leverage comparative strengths between government, industry, NGOs and academia for enhanced prevention, detection and control of HPAI and other emerging animal diseases.

During the first phase of the Private-Public Partnership (PPP) programme (funded by USAID), the stakeholders from both the public and private sectors in three target countries were identified. Their capacity, roles and responsibilities and level of collaboration were assessed, described and mapped. Integration of the private sector in decision making processes was strengthened through joint workshops and on the job training, but there is still much work to do.

Experience gained in this project will enable replication of successful activities in other countries and for other emerging animal diseases. Examples of the PPP programme's activities:

- Development of national biosecurity guidelines for the commercial poultry industry in Bangladesh and Egypt.
- Development of a strategic plan for compensation of HPAI affected farms in Egypt.
- Harmonization and sharing of all available biosecurity training materials between training providers and agencies and conducting biosecurity training for input suppliers to small poultry producers in Bangladesh.
- The restructuring of live bird markets in the greater Jakarta area and supporting the establishment of a National Poultry Quality Improvement Plan in Indonesia.

Source: FAO

Building core communication capacities and a critical mass of practitioners

Communication interventions, if properly planned and responsive to people's needs, play a critical role not just in the dissemination of information and increase in knowledge, but above all in facilitating changes in attitudes and adoption of protective behaviours. In order to ensure sustainability of the individual and community behaviours, it is necessary to undertake an integral approach to communication interventions and consider them as a

valuable and continual contributor to social wellbeing rather than merely as tools at hand to respond to emergencies.

Building core communication capacities and a critical mass of communication practitioners is another area which requires urgent and in-depth support for animal, human and environmental health stakeholders with clear linkages to urban planning sectors, trade and economic development decision-makers. The global communication response requires substantial improvement to prevent the spread of the H5N1 HPAI virus in poultry.

A unified and focused approach to rapidly building/strengthening core communication capacities among Ministries of Agriculture/Livestock, backed by the provision of hands-on technical assistance over the next 5-7 years by the international community is an imperative to eliminate the disease. In countries where the disease has either already become, or could become entrenched, there is need for a shift from emergency communication campaigns, to the mid to longer-term communication approaches, which calls for significant investments in building communication capacities and competencies in the animal health sector. Additional resources for specific multi-disciplinary research and analysis to inform the building of effective communication strategies will also be needed. Clear and internationally agreed indicators, benchmarks and pathways to strengthen these core communication capacities need to be established.

Mechanisms for long-term engagement and partnerships with the media, the commercial/private sector, small-scale poultry producers' associations, as well as civil society, are also seriously lacking, and have not been systematically and strategically addressed. Thus, among these important stakeholders, trust and confidence in national authorities and their policies remains tenuous.

Two crucial ideas also need to be systematically promoted society-wide through wide-scale public education interventions – over the long-term, but starting immediately:

- i. Promoting appropriate bio-security as a professional *norm* along the whole production and marketing chain, to ensure safe livestock production and market practices (in commercial, semi-commercial, backyard systems).
- ii. Promoting community-based reporting of suspect events and active public engagement in control measures as a social *norm*.

The avian influenza crisis has clearly demonstrated that communication specialists and practitioners also need to stop working in silos – whether institutional, or in terms of their particular disciplines (media relations, crisis communication, behaviour change communication, advocacy, social mobilisation, participatory communication, etc.). Health threats emerging today are by their very nature complex, interconnected, and potentially large-scale phenomena, which cannot be dealt in a naïve and fragmented manner, which pits media-focused crisis communication approaches using “key messages” against complex communication for social change processes. This gives primacy to the core principles of *participation, dialogue* and *empowerment*. Reducing risks/threats of a global nature calls for strategically re-thinking current communication practices, and building new approaches.

Gender analysis in livestock production and disease transmission

Further analysis and integration of socio-cultural factors is needed to strengthen livestock production and develop more sustainable and effective disease prevention, response and control. As women are frequently on the front lines of family health care and backyard poultry production, they can have a huge impact on reducing health risks for their families (and by extension, their communities), as well maintaining healthy poultry production and marketing. Making training and education available to women, as well as securing their access to and control over productive assets, are two examples of efforts that can be done on this front.

The principles outlined above also apply to management of other diseases beyond H5N1 and illustrate the importance of gender as part of a multidisciplinary approach to management of infectious diseases at the animal-human interface (see Case Study 2-9).

Case Study 2-9: Gender analysis and improving the effectiveness of Avian Influenza interventions

The relationship between gender and avian influenza (AI) has received increasing attention in recent years. Several programmes are addressing gender issues relating to AI actions, including the European Commission (EC), UN Joint Programme in Avian influenza in Vietnam, the ADB Greater Mekong Sub-region Communicable Diseases Control Project, FAO research in Vietnam, and the ASEAN +3 Emerging Infectious Diseases Programme.

In 2008, the European Commission (EC) completed a study concerning gender and AI in Laos, Thailand and Vietnam. The study found that many AI responses have not taken into account gender considerations, particularly the role of women and their possible contribution to responding to AI. Traditionally, men were considered farmers and the head of households, thus, men were usually invited to take part in training for AI control. However, women are also connected to livestock because of their considerable role in caring for small-scale backyard poultry. The results of the EC study highlight that women should be recognized as major stakeholders in dealing with AI, and that gender is a significant factor which can improve the effectiveness of AI achievements.

The ASEAN +3 Emerging Infectious Diseases Programme funded by AusAID completed a three-phase study in 2008 to generate information on gender impacts of dengue and AI in Cambodia, Indonesia, and Vietnam. The goal was to support ASEAN +3 countries with gender integration in pandemic prevention and AI interventions. Based on a survey which targeted communities that had been affected by dengue and AI in the past two years, the survey highlighted issues related to gender differentials in economic and household exposure to disease. The study also demonstrated strengths, for example finding that most household members were aware of and used government health centers, had a high level of knowledge on modes of transmission, signs/symptoms, and prevention and management of avian flu for both genders, and both genders understood the risks of AI.

The results of the ASEAN +3 study offered policy and programme proposals for dealing with gender differences and achieving gender equitable results. Actions for preventing and managing emerging infectious diseases such as a needs assessment, incorporation of gender concerns, training for gender sensitive policy and monitoring, among other activities were also identified. The recommendations from the ASEAN +3 study included an advocacy plan to motivate policymakers, and a social mobilization plan to raise community awareness and instruments for integrating gender in emerging infectious disease prevention and management programmes.

Source: ASEAN; European Commission

Strengthening links between veterinarians, biologists and environmental agencies

Coordination of activities such as surveillance in livestock, wildlife and human populations should be improved in order to improve efficiencies and sharing of data. Most importantly, this integrated coordinated system would be able to detect emerging infectious diseases at the animal-human-ecosystem interface. Problematic experiences with diagnosis of diseases such as the West Nile and Nipah viruses, could have been avoided with closer linkages between public health and veterinary surveillance and diagnostic systems¹³.

The benefits of joint public-animal surveillance systems would apply to all settings but are particularly relevant in remote and resource-poor areas. However, creating and sustaining such systems would require a legal framework and appropriate training with more emphasis on outbreak investigations, practical animal and public health measures, epidemiology and the wider effects of ecosystems and socio-cultural political aspects on human and animal health. In order for this collaboration to be effective and sustained, creation of appropriate institutional arrangements, technical assistance and a more reliable and sustained flows of financial resources would need to be established¹⁴.

Applied research

Improved international research capacity is also needed to accelerate early detection and thus timely and effective control of disease. Achieving this will require a comprehensive approach that adopts multidisciplinary, multinational, and multisectoral approaches. A better understanding of human interactions with animals, animal products, wildlife, and the natural environment could be established through applied research that addresses the complexity and multi-factorial nature of EIDs (9). Priority research areas could include 1) understanding the epidemiology of EIDs including disease vector(s), geography of vectors, pathogens, host, habitats and climate; 2) population vulnerability and the types of interactions (social and behavioural factors) that create opportunities for pathogens to “jump” species; 3) how to reduce risks; 4) transmission dynamics; 5) the role of wildlife ecosystems in global health and the triggers that affect the balance between different species in the same ecosystem; 6) the link between international economic trends and changes in ecosystems; and 7) resultant threats to populations leading to emergence of diseases and drivers of spread.

Further, applied research could be considered which addresses: a better understanding of the barriers to preventing and controlling EIDs both in animals and humans; assessing the effectiveness of tools for detecting, forecasting the spread of EIDs; gaining a better understanding of the advantages of different intervention approaches and how communities can be engaged to more actively participate in animal and public health activities to reduce their vulnerability.

2.5 Conclusions

2.1 Detailed update of the global H5N1 HPAI Situation (2009 – 2010).

- H5N1 Highly pathogenic avian influenza remains entrenched in domestic poultry in several regions of the world with Bangladesh, Indonesia, Vietnam, Egypt and China remaining hotspots for H5N1. Both Vietnam and Egypt have experienced an increased number of outbreaks during 2009, compared with 2008. Other countries that continue to be affected by outbreaks include Cambodia, Lao PDR, India, and Nepal.
- While the spread and transmission of H5N1 HPAI mostly relates to poultry production and trade, there have been reduced numbers of wild bird outbreaks reported during 2009 (compared to 2008) in China, Mongolia, Russia and Germany.
- All human cases have occurred in countries with ongoing circulation or reintroduction of H5N1 viruses in poultry. No new countries have recorded human cases of avian influenza H5N1 infection in 2009, representing a steady decline in the number of new countries recording human cases since 2006. The speed of detecting human infections in most affected countries has remained unchanged, with the exception of Egypt. Strengthened human disease surveillance and reporting is still required in most affected countries to reduce CFRs for human cases.
- Influenza viruses continually change through mutation and reassortment in unpredictable ways. There is global consensus that we must improve our understanding of the characteristics of circulating high and low pathogenic avian influenza viruses, to prevent a progressive increase in zoonotic influenza A viruses. We must control and/or eradicate highly pathogenic avian influenza in domestic livestock, to minimise reservoirs in both humans and animals, and remain vigilant at all times.

2.2 Progress to date with H5N1 HPAI control

Management of H5N1: mitigation efforts in endemic countries

- Mitigation strategies are moving from short term emergency responses to longer term sustained approaches and global understanding of the social, cultural, gender and economic consequences of both the disease and the interventions are improving.
- Much has been learned about vaccination strategies, and some countries are transitioning from mass vaccination of poultry to more targeted and cost effective measures based on multi-disciplinary approaches. If large scale vaccination is used, strengthened epidemiological capacity is needed to ensure sound risk assessments and monitoring.
- Compensation policies have progressed towards more context specific policies, with closer collaboration between legal experts, the private sector and public sector ministries, as well as harmonising policies across borders.

Progress with strengthening healthy poultry production and vigilance in all countries (based on FAO November 2009 survey results)

- Surveillance has improved in most countries, though further improvements including risk analysis (epidemiological capacity), stronger engagement with the private sector and greater levels of surveillance at the domestic poultry/wild bird interface are needed.

- Progress with laboratory capacity has been limited, largely due to limitations with funding for laboratory maintenance in many developing countries. Good progress has been made with sub-regional and regional laboratory networks in Africa; further work is required to strengthen networks in Central Asia and Eastern European countries.
- Veterinary legislation is an essential element for surveillance, early detection and control of animal diseases, animal production food safety and certification of animals and animal products for export. In many countries veterinary legislation remains outdated and inadequate to support animal health requirements.
- Very few countries have established biosecurity measures since 2008, and the global level of biosecurity in the poultry production chain remains low. Major constraints include a lack of legal/regulatory frameworks to enforcement of biosecurity measures, limited incentives and awareness of benefits.

Progressive control of H5N1 HPAI in countries

- Key elements of sustainable progressive control include evaluative assessments which: (a) take a risk-based approach to the development of interventions i.e. assess the risk of introduction based on potential pathways for the disease introduction and subsequent transmission and an understanding of poultry production and market chains (b) ensure effective surveillance systems are supported by competent laboratories for early detection (c) provide authority to manage rapid response actions – actions that are guided by community as well as expert decision making (d) have communication and community engagement, public-private partnerships at the core of control activities and (e) support strong veterinary services.
- Key actions for countries with endemic H5N1 include broader partnerships between sectors, and public-private interests, broader focus to include the entire poultry value chain – with particular emphasis on distribution and marketing, direct involvement of local communities, decentralised prevention and control, engagement of health authorities, and medium to long term structural change.
- In countries with entrenched H5N1, there is a need for a shift from emergency communication campaigns to longer-term communication approaches. This calls for investments in building communication capacities in communities and across the animal production and human health sectors.
- Long-term political and industry commitment needs to continue in endemic settings with ongoing assessments of risk, the implementation of flexible and customized arrangements to manage and promote society-wide awareness of risk.
- Key actions for non-endemic countries and areas that remain at risk include: market-based risk reduction strategies, and ongoing awareness, vigilance particularly at the farm level and surveillance. This includes establishing a stronger understanding of disease drivers and long-lasting investments to maintain healthy livestock and address other important animal diseases

Progressive control of H5N1 – how it is different and areas for greater focus

- Progressive control features long-term planning and sustainability, political and industry commitments supported by adequate resources, taking account of socio-economic and gender impacts, and understanding the opportunities and barriers for technical options.

- Veterinary systems are notably weak in many countries around the globe in terms of governance, surveillance and diagnostic structures, quality education, and remuneration. Animal production and marketing do not have the regulatory framework to support proper practices and hygiene in many countries, and especially in remote areas. The interface between human and veterinary medicine remains weak and is inadequately financed.
- Control of a disease at its animal source is far less costly than tackling the ensuing epidemic in humans. Supporting development of veterinary services in developing/in transition countries remains a high priority.
- There are strong disparities between the policy goals for public health, agriculture food production systems and sustainable farming approaches, and economic development, improved synergies are needed to bridge these barriers.
- Long term communication interventions are needed society-wide to promote:
 - appropriate bio-security as a professional *norm* along the whole production and marketing chain, to ensure safe livestock production and market practices (in commercial, semi-commercial, backyard systems); and
 - community-based reporting of suspect events and active public engagement in control measures as a social *norm*.

This requires establishment of core communication capacity and a critical mass of communication practitioners for animal health issues.

- Comprehensive research approaches that adopt interdisciplinary, multinational and multisectoral approaches are needed to ensure that human interactions with animals, animal products, wildlife and the natural environment are well studied through applied research that address the complexity and multi-factorial nature of EIDs. Socio-economic and political applied research is also critical to understanding the influences on behaviour, incentives for change, risk reduction and priority-setting.

2.6 Appendices

Annex 1: Notification of H5N1 outbreaks received by the OIE for 2009 and 2010 (updated on 08/02/2010)

Country	Date of confirmation	Date of submission	Resolved date	Number of outbreaks	Serotype	Wild/Domestic
Bangladesh	22/03/2007	30/03/2007	Continuing	325	H5N1	Domestic
Cambodia	18/12/2009	28/12/2009	27/12/2009	1	H5N1	Domestic
	29/01/2010	05/02/2010	Continuing	1	H5N1	Domestic
China (People's Rep. of)	10/02/2009	10/02/2009	03/05/2009	2	H5N1	Domestic
	17/05/2009	17/05/2009	Continuing	2	H5N1	Both
Egypt	17/02/2006	18/02/2006	Endemic disease	1086	H5N1	Domestic
Germany	06/03/2009	11/03/2009	06/03/2009	1	H5N1	Wild
Hong Kong (P.R. China)	08/12/2008	12/12/2008	05/01/2009	1	H5N1	Domestic
	31/01/2009	13/02/2009	16/04/2009	12	H5N1	Wild
	31/12/2009	05/01/2010	29/12/2009	1	H5N1	Wild
India	27/11/2008	28/11/2008	22/10/2009	28	H5N1	Domestic
	14/01/2010	15/01/2010	Continuing	4	H5	Domestic
Indonesia	19/07/2006	25/09/2006	Endemic disease	6	H5N1	Domestic
Israel	26/01/2010	26/01/2010	02/02/2010	1	H5N1	Domestic
Japan	25/04/2008	29/04/2008	01/04/2009	5	H5N1	Wild
Laos	09/02/2009	26/02/2009	04/04/2009	1	H5N1	Domestic
Mongolia	25/05/2009	28/05/2009	29/07/2009	1	H5N1	Wild
	06/08/2009	10/08/2009	12/10/2009	1	H5N1	Wild
Myanmar	03/02/2010	05/02/2010	Continuing	1	H5N1	Domestic
Nepal	16/01/2009	16/01/2009	25/02/2009	2	H5N1	Domestic
	31/01/2010	05/02/2010	Continuing	1	H5N1	Domestic
Russia	12/06/2009	24/06/2009	24/06/2009	1	H5N1	Wild
	28/10/2009	05/11/2009	13/01/2010	1	H5N1	Wild
Togo	16/09/2008	18/09/2008	16/01/2009	1	H5N1	Domestic
Vietnam	19/12/2006	19/12/2006	Continuing	235	H5N1	Domestic

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