FAOAIDEnews
Animal Influenza Disease Emergency

Situation Update 66
15 May 2010

HPAI outbreaks reported in this publication refer to officially confirmed cases only.
The information is compiled from the following sources: World Organisation for Animal Health (OIE), national governments and their ministries, and the European Commission (EC) – these sources are responsible for any errors or omissions.

FAO supports HPAI control efforts in India

Cross-border trade of poultry and poultry products is facilitated by land-based movement corridors that link production clusters with consumption centres throughout South and Southeast Asia. Although cross-border trade is motivated by profit-seeking incentives amongst interested parties on both sides of the border, it oftentimes comes with unintended consequences. For instance, animals can carry diseases that can also infect humans, thereby posing public health threats on either side of the border.

People's actions bring disease agents and animal hosts together; therefore, people involved in poultry rearing and trade need to be seen as critical in terms of animal disease risk management within and across borders, especially of highly pathogenic avian influenza (HPAI) which continues to cause economic losses to Asian poultry farmers and traders, and also poses a pandemic threat due to its endemic nature in a few countries in Asia.

In response, the Food and Agriculture Organization of the United Nations (FAO), in collaboration with the Animal Resource Development Department (ARDD) of the West Bengal [India] Government, organized a series of two-day orientation/sensitization workshops titled 'strengthening cross-border emergency preparedness and response mechanisms against HPAI'. The workshops aimed at raising awareness about disease prevention and control and also equipping people with the necessary knowledge to contain a sudden outbreak of HPAI in high-risk border regions.

One of the most pressing challenges to avian influenza risk management in the years to come is identifying and understanding which anthropogenic practices effectively reduce disease risks while improving people's ability to supply stable and safer poultry commodities and protect rural livelihoods. This can only be achieved by actively engaging communities and those involved in poultry production and marketing systems, and by understanding crucial socio-economic factors, in particular those related with incentives, practices and trading patterns.

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AIDEnews is an FAO ECTAD publication
Editor: Sigfrido Burgos, ECTAD Communication Unit (*sigfrido.burgos@fao.org*)

For its part, FAO will continue to contribute to the national and regional efforts in Asia to monitor and control emerging infectious diseases, and mitigate its impacts by promoting comprehensive and proactive approaches to disease risk management that combine interlocking elements such as foresight, prevention, impact mitigation, early detection, and swift and effective animal health responses.

Lessons from avian influenza prevalence in wild birds in Iran

Global scientific data clearly demonstrates that low pathogenic avian influenza (LPAI) viruses are widely distributed in wild bird species around the world; most frequently found in ducks, geese, swans, gulls and terns. Most experts believe that the current H5N1 highly pathogenic avian influenza (HPAI) virus was originally introduced from wild birds to poultry as a LPAI virus. Subsequently, this virus mutated in poultry from low to high pathogenicity, and then spilled back into the wild bird population. Given this evolving interplay among viruses that circulate back and forth between domestic and wild birds, and the potential for mutations to take place in intensified poultry systems leading to human pandemic disease threats and big impacts to national economies and livelihoods, it is important that we maintain appropriate levels of influenza virus surveillance in healthy wild bird populations, poultry, and humans.

In Iran, the first outbreak of H5N1 HPAI was confirmed on 15 February 2006. From 2003 to 2007, a series of molecular, serological and virological studies were carried out to determine the status of avian influenza virus infections in different species of wild water birds in Iran. Samples (cloacal, oropharyngeal and serum) were collected in six different Iranian provinces —which are representative of the 15 most important wintering sites of migratory water birds— from 1146 birds encompassing 45 different species. Molecular and virological analyses detected LPAI viruses in 3.4% of samples and no HPAI viruses, including H5N1. Serological analyses revealed that almost half (48.5%) of 711 serum samples tested positive for avian influenza virus antibodies, with duck-specific antibody prevalence ranging from 44 to 75 percent.

Viewed from a broader ecological perspective, and in consideration of the lack of HPAI detection, these findings contribute important information to the increasing body of evidence regarding the prevalence of low pathogenic avian influenzas in wild birds in Iran, especially around Caspian Sea wetlands that serve as wintering site for migratory water birds along their trans-continental journey. Specifically, it is noteworthy that Mallard and Common Teal exhibited the highest number of positives in virological and serological investigations, therefore suggesting that these two duck species may play an important role in the introduction, establishment and dissemination of LPAI viruses between and within avian species in the Southern Caspian Sea region, although their possible role in H5N1 HPAI is still to be determined.

For its part, the Food and Agriculture Organization (FAO) continues to contribute to the national and regional wildlife and domestic poultry surveillance efforts in Central Asia to control emerging avian infectious diseases and mitigate their impacts by promoting comprehensive and proactive approaches to disease risk management. These same approaches are being used by FAO and partners to conduct surveillance for other common and emerging infectious diseases in the region.

MOST RECENT H5N1 AI OUTBREAKS 2006-2010

Note: This list has been compiled on the basis of information up to 15 May 2010.

2010

May	**Mongolia**, Viet Nam
April	Bangladesh, Egypt, Israel, Lao PDR
March	Bhutan, **Bulgaria**, China (Hong Kong), Myanmar, Nepal, Romania
January	Cambodia, India, Indonesia

2009

October	Russian Federation
August	**Mongolia**
May	China
March	Germany
February	Lao PDR

2008

November	Thailand
September	Togo
July	Nigeria
June	Pakistan
May	Japan, Korea (Republic of), United Kingdom
March	Turkey
February	**Switzerland**, Ukraine
January	Saudi Arabia

2007

December	Benin, Iran, Poland
October	Afghanistan
August	France
July	Czech Republic
June	Ghana, Malaysia
April	Kuwait
January	Côte d'Ivoire, Hungary

2006

August	Sudan
July	**Spain**
June	Niger
May	Burkina Faso, Denmark
April	Djibouti, Sweden, West Bank & Gaza Strip
March	Albania, Austria, Azerbaijan, Cameroon, **Croatia**, **Greece**, Jordan, Kazakhstan, Serbia, **Slovenia**
February	**Bosnia-Herzegovina**, **Georgia**, Iraq, **Italy**, **Slovakia**

***Green**: areas which never had reported outbreaks in poultry*

Sources: World Organisation for Animal Health (OIE), European Commission (EC), FAO and national governments

AT A GLANCE

The latest HPAI outbreaks for the period 1 April 2010 –15 May 2010

Note AIDEnews publishes reports of **confirmed HPAI cases** using the following sources: OIE, European Commission, FAO and national governments.

AFRICA

EGYPT

A total of 34 H5 HPAI positive cases were reported in 14 governorates during 1 April - 15 May: Behaira (2), Beni-Suef (1), Dakahlia (1), Fayoum (1), Gharbia (1), Helwan (1), Kafr-el-sheikh (5), Luxor (2), Menia (2), Menofia (7), Port Said (1), Qalioubiya (6), Sixth of October (3), Suez (1) (The number of outbreaks in the governorate is in brackets). There were 8 commercial farms found infected during this period, of which 6 farms (75%) have been vaccinated against avian influenza; of the 6 vaccinated-and-infected farms, 4 farms were in Qalioubiya Governorate.

ASIA

BANGLADESH

Outbreaks of H5 HPAI in Dhaka Division (Kishoreganj and Mymensingh Districts) were reported in April. The latest outbreak occurred on 17 April in Kishoreganj Sadar Upazila, Kishoreganj District, Dhaka Division.

INDONESIA

The Participatory Disease Surveillance & Response (PDSR) programme, through 31 Local Disease Control Centres, covers 67,136 villages in 78% of Indonesia's 448 districts and municipalities in 29 of its 33 provinces. During March 2010, PDSR conducted surveillance in 1,984 villages (3%) in 27 Provinces. The overall HPAI incidence was 1.5 newly found infected villages per 1000 villages in the coverage area, but incidence varied widely between provinces. The four highest provinces for incidence were Kepulauan Bangka Belitung (13.3), Yogyakarta (9.1), Lampung (7.2) and Jambi (4.6). The four highest village visit rates during March occurred in Yogyakarta (18.0%), Kepulauan Bangka Belitung (10.3%), Bali (8.2%) and Lampung (6.0%).

LAO PDR

An outbreak of H5N1 HPAI reported in Xaythany District, Vientiane Capital, 44 out of 1004 layers died in a farm. H5N1 HPAI was confirmed by real time-PCR at the National Animal Health Centre (national laboratory).

MONGOLIA

A total of 26 whooper swans (Cygnus *cygnus*) and greylag geese (*Anser anser*) died at Ganga Lake, Dariganga Soum, Sükhbaatar Aimag on 3 May 2010. On 8 May, H5N1 HPAI was confirmed by the national laboratory by HA, RT-PCR and RRT-PCR.

VIET NAM

Outbreaks of H5N1 HPAI occurred in Quang Ninh, Quang Ngai and Quang Trị Provinces in April and Dak Lak Province in May were reported on the Government website. The last outbreak occurred between 8 and 13 May 2010 in ducks in Ea Hu Commune, Cu Kuin District of south-central Dak Lak Province. Currently Quang Ngai, Quang Trị and Dak Lak Provinces are under 21 day monitoring period.

MIDDLE EAST

Israel

Between 29 April 2010 and 4 May 2010, two emus (*Dromaius novaehollandiae*) died after losing appetite in a small zoological garden in Ein Gedi, Hadarom District. Their brain samples tested positive for H5N1 HPAI by PCR.

This overview is produced by the FAO-GLEWS team, which collects and analyses epidemiological data and information on animal disease outbreaks as a contribution to improving global early warning under the framework of the Global Early Warning for Transboundary Animal Diseases (TADs) including Major Zoonoses.
glews@fao.org

WORLDWIDE SITUATION

In March 2010, 196 H5N1 HPAI poultry outbreaks were observed officially in Bangladesh, Bhutan, Egypt, Indonesia, Myanmar, Nepal, Romania and Viet Nam. Two wild bird cases were reported in China and Bulgaria. The number of reported outbreaks/cases by country and their location are illustrated in Figures 1 and 2, respectively.

FIGURE 1
H5N1 HPAI outbreaks/cases in poultry and wild birds in March 2010
(Source: FAO EMPRES-i)

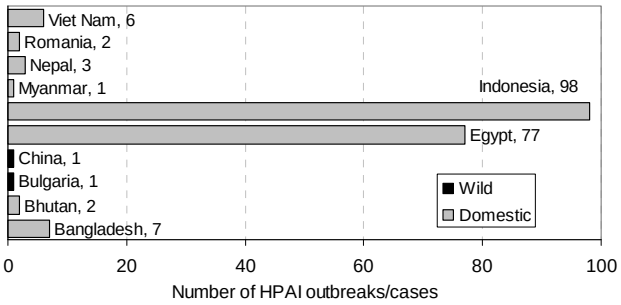
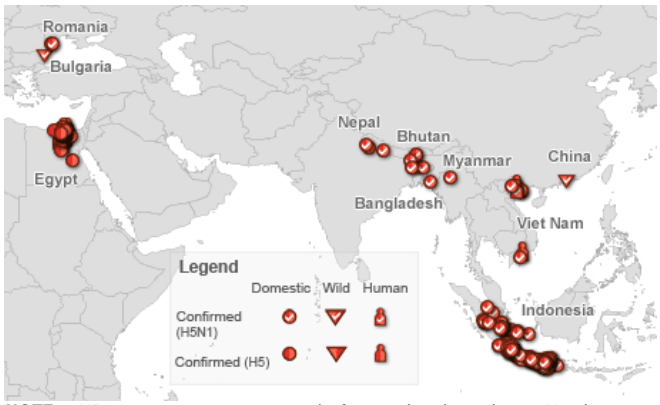


FIGURE 2
H5N1 HPAI outbreaks/cases reported in poultry, wild birds and humans in March 2010
(Source: FAO EMPRES-i)

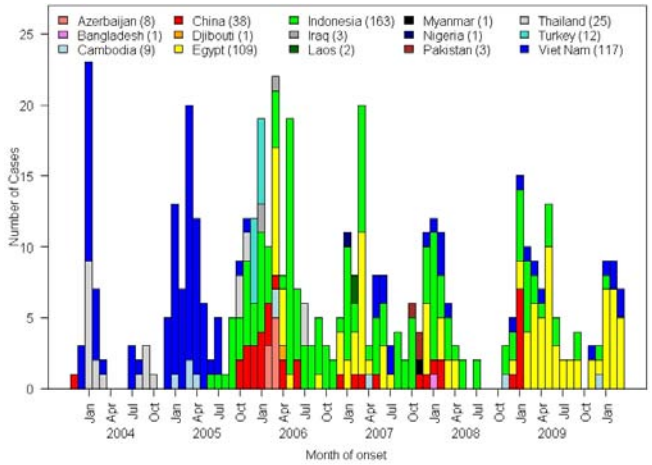


NOTE: H5 cases are represented for outbreaks where N-subtype characterization is not being performed for secondary cases or if laboratory results are still pending. Countries with H5 and H5N1 occurrences only in wild birds are not considered infected countries according to OIE. The original data have been collected and aggregated at the most detailed administrative level and for the units available for each country.

Figure 3 shows the confirmed cases of H5N1 infections in humans reported to the World Health Organization (WHO) by country over time. Between November 2003 and March 2010, 494 human cases of H5N1 infection were reported to WHO from 15 countries, of which 292 were fatal, a case fatality rate (CFR) of 59%. Among the countries with more than ten reported cases, Indonesia had the highest CFR of 83% (135 out of 163). Age distribution of the reported human cases in all countries ranged from three months to 81 years of age (median 18 years of age, n=474). Cases between 0 and 9 years of age were most common (30%). The highest CFR (74%) was in persons aged 10-29 and the lowest (25%) in persons aged 70 and above. Gender was equally distributed, with 52% of the cases being females (244/469). Indonesia did not report on the age and gender of the 2009 cases (Source: Western Pacific Regional Office of WHO, Avian Influenza Update).

In 2008, 44 cases (33 fatal – 75%) were confirmed, with Indonesia reporting the highest number (24 cases, 20 fatal), followed by Egypt (eight cases, four fatal), Viet Nam (six cases, five fatal), China (four cases, all fatal), Cambodia (one case) and Bangladesh (one case). In 2009, 73 cases (32 fatal - 44%) were reported: 39 from Egypt (four fatal), 21 from Indonesia (19 fatal), seven from China (four fatal), five from Viet Nam (all fatal) and one from Cambodia (Source: Western Pacific Regional Office of WHO). As of 31 March 2010, 26 human cases had occurred: 19 in Egypt (seven fatal), six in Viet Nam (two fatal), and one in Indonesia (fatal).

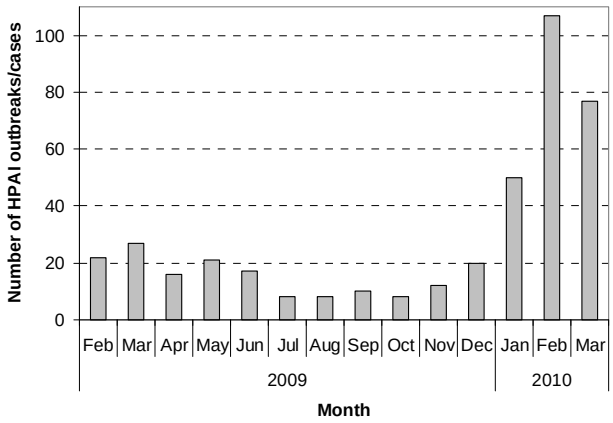
FIGURE 3
Cases of H5N1 AI infections reported in humans by country and month of onset since November 2003
(Source: World Health Organization - WHO)



SITUATION BY CONTINENT/REGION

Africa

FIGURE 4
H5N1 HPAI poultry outbreaks in Egypt between February 2009 and March 2010
(Source: FAO EMPRES-i)



Egypt reported the first H5N1 HPAI outbreak in February 2006. Despite a vigorous initial response to the disease, including the culling of over 40 million birds, Egypt is considered as an endemic country where outbreaks are regularly reported from different governorates. In March 2010, 77 H5 HPAI outbreaks were observed in poultry (chickens, ducks and turkeys) from Alexandria (1), Beni-Suef (6), Dakahlia (4), Fayoum (3), Gharbia (5), Giza (1), Helwan (2), Kafr-el-sheikh (8), Menia (4), Menofia (23), Qalubia (6), Sharkia (4), Sixth of October (9), and Suez (1) governorates. Of these, 59 outbreaks (76%) were reported from the household poultry sector. Sixty-two of the 77 outbreaks occurred in non-vaccinated birds while the remaining 15 outbreaks occurred in vaccinated birds. During March 2010, Community Animal Health Outreach (CAHO) teams visited 48 villages in ten governorates and detected 10 (13%) of the above-reported confirmed outbreaks. CAHO teams operate in high-risk governorates and collect samples only from suspected cases.

Poultry farms are required to test their birds and receive certification (HPAI infection negative status) prior to any planned transportation. During March 2010, 2 779 samples were collected for this purpose, nine of them confirmed positive for HPAI, from five governorates. In Egypt, compliance with certification for poultry transportation is generally sub-optimal, as only registered farms (<20 % of the farms) seek such services.

During March 2010, 103 farms in eleven governorates were subjected to active surveillance and six of them were confirmed positive for HPAI infections. On the other hand, three of seven HPAI notifications (passive surveillance) received from commercial poultry farms were found to be positive for H5 HPAI.

By way of active surveillance, 35 out of 200 household poultry units sampled in 16 governorates were confirmed as H5 HPAI. Conversely, 14 of the 45 suspected outbreak notifications (passive surveillance) from nine governorates were confirmed positive to H5 HPAI. Besides this, 33 samples collected at road check points were found to be negative for HPAI.

The current government policy is to allow commercial poultry farms to vaccinate their flocks with registered vaccines of their choice. Although there are no official data, it is assumed that vaccines are widely used in the commercial poultry sector. All AI vaccines used in Egypt (at least 21) are inactivated (mostly H5N2) and imported. For three years, the government provided vaccination to household/village poultry free of charge until July 2009, when vaccination was suspended until further notice, because of a limited or no impact on H5N1 HPAI incidence. A recent assessment study conducted by FAO and the General Organisation for Veterinary Services

(GOVS), in the framework of the Strengthening Avian Influenza Detection and Response (SAIDR) project, revealed that vaccination coverage was under 20% and flock immunity under 10% in the household sector. The study also highlighted substantial weaknesses in the current immunization programme, mainly due to the difficulties of blanket vaccinations in the semi-commercial and household poultry sectors, lack of sufficient funding and communication support, absence of an efficient monitoring system, and inadequate training of field technicians. More information can be found in Peyre et al. (2009) at http://www.libpubmedia.co.uk/MedJ-Issues/Issue-5/Peyre.pdf.

Live bird markets (LBMs) are key links between commercial and household poultry sectors. Egypt has recently implemented bans on selling live birds at open markets (Law 70/2009, MOALR MD 941/09), but the ban has had little effect and LBMs continue to operate. Some governorates are enforcing decrees related to the closure of unregistered poultry farms and control of bird movements. Enforcement varies from one governorate to another, but is generally weak.

In March 2010, five human avian influenza A H5N1 cases were reported, in an 18-year old female from Fayoum Governorate (fatal), a 30-year old female from Damietta Governorate, a four-year old male from Beni-Suef Governorate (fatal), a 20-year old pregnant female from Qaliobia Governorate (fatal), and an 18-month old male from Kafr-el-sheikh Governorate.

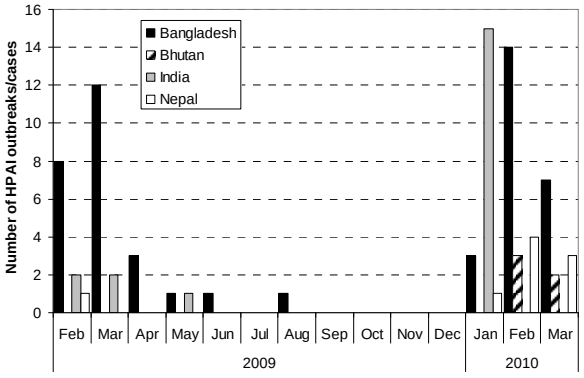
Of the 109 human laboratory-confirmed cases of influenza A H5N1 reported in Egypt since the beginning of the epidemic, 34 (30%) have been fatal. Compared with 2009, when most cases were in children under four years of age, 14 out of the 19 human infections so far reported in 2010 have been in patients over that age. The observed CFR is also higher so far in 2010 (37%) compared with 10% in 2009, when it dramatically decreased from 50% in 2008. The relative increase in H5N1 HPAI outbreaks in poultry (239 in 2010 compared with 55 in the same period in 2009) may be a result of the improved surveillance and reporting rate, mainly because of the effectiveness of CAHO.

In May 2008, serum and nasal swabs were collected from 240 pigs (11 herds) in Cairo slums, where pigs feed on organic remains, including dead birds, and thus have a higher chance of becoming H5N1-infected. Although all nasal samples were negative to by real-time PCR, seroprevalence for avian influenza was 1.67% and 4.6% (for non-local H5N2 and local H5N1 viral antigens, respectively). Of the 11 positive pigs, eight were from one herd and three from three other herds. More details are available in El-Sayed *et al.* (2010) at http://www.cdc.gov/EID/content/16/4/726.htm.

In a recent study by Abdel-Moneim *et al.* (2010) available at http://www.jbiomedsci.com/content/17/1/25, nasal swabs were collected from three donkeys suffering from respiratory distress in March 2009, one week after a H5N1 HPAI poultry outbreak in Aborady Village, El-Wasta Locality, Beni-Suef Governorate, where many donkeys suffered from the same clinical manifestations in an epidemic manner. Sequences were deposited in GenBank. Phylogenetic analysis showed that the virus clustered within the lineage of H5N1 from Egypt, closely related to 2009 isolates. One hundred and five serum samples were collected from apparently healthy donkeys from different localities in the Beni-Suef Governorate, four to six months after the virus isolation. H5 specific antibodies were detected in 27 out of 105 (25.71%) of the examined animals, with the highest percentage found in the area where the virus was isolated, suggesting donkey-to-donkey transmission.

South Asia

FIGURE 5
H5N1 HPAI outbreaks/cases in poultry/wild birds in South Asia, by country, between February 2009 and March 2010
(Source: FAO EMPRES-i)



In **Bangladesh**, seven outbreaks in chicken layer farms occurred across the country in Jaipurhat (2), Nilphamari (1), Mymensingh (1), Chittagong (1), Thakurgaon (1) and Naogaon (1). Viral samples, including three samples isolated in January 2010, were shipped for sequencing to the OIE/FAO Reference Laboratory for Avian Influenza and Newcastle Disease in Padova, Italy. The phylogenetic analysis showed that all isolates belonged to Clade 2.2. In particular, these isolates grouped in sublineage III and clustered with sequences of viruses from Bangladesh isolated from 2007 to 2009. These results indicate that the virus is being maintained in reservoirs unnoticed within the country. The emphasis of the current policy of the government is placed on early detection and containment by culling as well as the improvement of bio-security in various production sectors.

As of 31 March 2010, a total of 350 outbreaks had been recorded in 47 out of 64 districts on both commercial farms and in backyard holdings and over 1.8 million birds had been culled. Poultry vaccination against H5N1 HPAI is prohibited by the government. FAO is coordinating and supporting active surveillance that has been expanded to 260 upazillas (sub-districts) across the country, including the innovative use of the Short Message Service (SMS) gateway (method of sending and receiving SMS messages between mobile phones and a computer) as a reporting tool. Daily, in each Upazilla three community animal health workers employed by the active surveillance programme send SMS coded text messages to the Department of Livestock Services, reporting disease and death in poultry. SMS messages of suspected AI events are automatically forwarded to the livestock officer in the area, who starts an investigation. In March, 23 349 SMS messages were received, including 19 suspected HPAI events in backyard poultry and 82 suspected events on commercial poultry farms. The veterinary investigations that followed discounted 41 of these suspect cases and on 60 occasions diagnostic specimens were collected. Of all specimens collected and reported through the SMS gateway system, seven tested positive for H5N1 HPAI.

FAO has partnered with Wildlife Trust Bangladesh (WTB), Wetlands International, Wildlife Trust (USA), United States Geological Survey (USGS) and ICDDRB to undertake a wild bird telemetry project in Bangladesh. This project is also collaborating with the Bombay Natural History Society in India, which is placing identification rings on the legs of 30 avian species for additional tracking studies. Satellite-based telemetry consists of placing a backpack with a radio transmitter on a wild bird and tracking the emitted signals to map its daily movements. In Bangladesh, migratory birds stop over every year on their journeys along the 'Central Asian Flyway' and the 'East Asian-Australian Flyway'. Scientific evidence suggests that wild birds can be asymptomatic carriers of numerous avian influenza viruses. The project selected specific avian species that travel the longest distance routes, for example from the Arctic to Bangladesh via Mongolia and the Himalayas. This year, it is planned that additional birds will be fitted with transmitters before the migration season starts. The tagged birds are tested for avian influenza exposure or infections through blood and faecal samples before they are returned to their natural habitats. The data gathered will be used to assess the flight patterns, including altitude, routes and duration of flights, time spent at each location along their flyways, survival rates and retrospective correlation of stopover sites with reported disease outbreaks. This way, objective and verifiable evidence will be available to further elucidate the role of migratory birds in the spread of H5N1 HPAI.

In **Bhutan** two H5N1 outbreaks were reported in scavenger poultry in a hilly region of Chukha District in Phuentsoling and Samphelling *Geogs*. During February 2010 the country reported its first ever outbreaks of the disease. Samples were sent to international laboratories, including the OIE/FAO reference laboratory in India, the High Security Animal Disease Laboratory (HSADL), Bhopal. Phylogenetic analysis confirmed Clade 2.2. The first case occurred near to a main road in Phuentsoling *Geog* and subsequently a community-based 'Focal Person' in a remote rural community reported suspicious mortality of two scavenger chickens, subsequently confirmed as H5N1

HPAI. The disease was controlled by culling affected and in-contact poultry, burning coops, disinfection and disposal of culled birds and poultry products by burial. Over 4 000 birds were culled.

In **India**, after no notification of outbreaks since 27 May 2009 (in West Bengal), H5N1 HPAI outbreaks were reported during January 2010 in the Khargram and Burwan blocks of Murshidabad District in West Bengal, all in backyard poultry. However, no outbreaks were observed during February or March 2010. The 2010 virus isolates are similar to those of 2008 and 2009 (Clade 2.2).

According to the last surveillance between 1 and 28 March 2010, 7 852 active surveillance samples were received at HSADL, Bhopal. Testing was completed on 14 219 samples (some from the previous month), all with negative results, and another 5 915 were under test or pending. The periodical reports (available at http://www.dahd.nic.in/) include the number of samples received and tested per state.

A three-year long Uttar Pradesh Forest and Wildlife Department project on "Migratory Movements of Waterbirds and Surveillance of Avian Diseases" has collected approximately 240 samples since January 2009, mostly from migratory bird species. During December 2009, 23 migratory waterfowl trapped in the states of Assam and West Bengal as part of an FAO-facilitated satellite tag marking project, were successfully 1) marked with satellite transmitters, and 2) had feathers collected for genetic and isotopic analyses. Swab samples (oral and cloacal) and blood samples were collected for AI testing from 93 wild waterbirds and 47 domestic waterfowl. Additional sampling took place in January 2010 (http://www.fao.org/avianflu/en/wildlife/sat_telemetry_india.htm). Laboratory results are still pending. In addition, as a follow-up to the above study, six more migratory birds were marked with satellite transmitters during late January and February 2010.

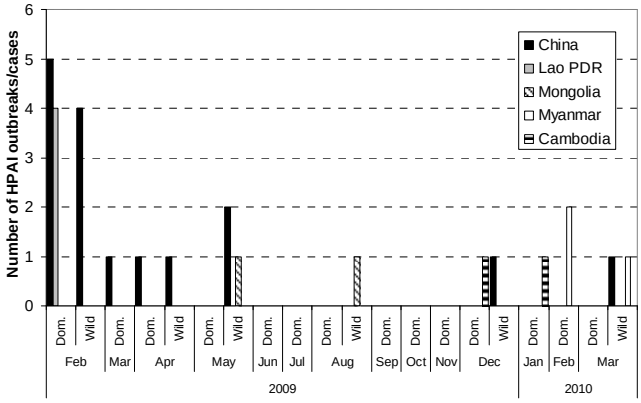
In **Nepal**, the outbreak in Kaski District detected at the end of January spread, despite control measures, to ten secondary outbreaks (referred to as hotspots in Nepal) and a further three in the neighbouring district of Tanahu. During February, further outbreaks were detected in Chitwan (1), Banke (5) and Dang (1) districts, all of which border India. March saw additional outbreaks in this border area, with occurrences in backyard poultry in Banke, Kailali and Nawalparasi (one outbreak with five related hotspots) districts. With the exception of three samples from Kaski District that had given H5N1 Clade 2.2, all samples submitted to the Veterinary Laboratories Agency (VLA), Weybridge, have produced H5N1 Clade 2.3.2. Clade 2.2 was experienced one year ago in Nepal's eastern region and Clade 2.3.2 viruses were most related to viruses isolated in wild birds in 2009 from the Russian Federation and Mongolia. The potential for wild bird introduction needs to be considered as a possibility. More distant Clade 2.3.2 viruses were also isolated in wild birds in Hong Kong SAR, China, and in poultry in Viet Nam.

South East and East Asia

FIGURE 6

H5N1 HPAI outbreaks/cases in poultry/wild birds in East and South East Asia, by country (excluding Indonesia and Viet Nam), between February 2009 and March 2010

(Source: FAO EMPRES-i)



In **Cambodia**, after the January 2010 outbreak in ducks in Takeo Province, no further HPAI outbreaks were observed in February or March 2010. So far, all available human and animal isolates since 2004 are Clade 1, the same clade that circulates predominantly in southern Viet Nam.

Cambodia routinely reports results obtained from surveillance activities through two hotlines supported by FAO at the National Animal

Veterinary Research Institute (NaVRI). There is also ongoing duck market surveillance at 12 live bird markets in 11 provinces conducted by NaVRI (and supported by FAO) since 2007. None of the samples collected so far have tested positive for H5N1 HPAI.

In 1996, **China** first identified HPAI viruses of the H5N1 subtype in geese in Guangdong Province, and H5N1 HPAI viruses have continued to circulate and evolve since then. Almost 200 H5N1 HPAI outbreaks have been reported in poultry and wild birds in 29 provinces since 2004 and a total of over 35 million poultry have been culled to control the spread of the disease. While 2008 was marked by a slight increase in the number of cases in domestic poultry compared with 2007, only two outbreaks were reported in mainland China in 2009 (Xinjiang autonomous region in February and Tibet autonomous region in April 2009), showing a steady decrease in the number of outbreaks reported since the beginning of the epidemic in 2004. During March 2010, a dead barn swallow found in Yuen Long, Hong Kong SAR, tested positive for H5N1 avian influenza. Barn swallows are common visitors to Hong Kong SAR in spring and summer.

However, official ongoing surveillance activities conducted at national and provincial levels provided evidence that H5N1 viruses were still circulating in many provinces. Out of 424 606 samples collected between January to September 2009, 80 H5N1 viruses in ducks (62%), chickens (34%) and geese (4%) were detected in Xinjiang autonomous region, Hunan, Hubei, Chongqing, Henan, Shandong, Guangdong, Guangxi autonomous region, Fujian, Sichuan and Guizhou. Sixty-five percent of all virological samples were collected from chickens, 20% from ducks, 6% from geese and 2% from wild birds, the rest being collected from pigs and other species. The last national surveillance results released by the Ministry of Agriculture in November 2009 in the Official Veterinary Bulletin reported seven new viruses isolated from 23 962 samples. These H5N1 HPAI viruses were detected in chickens and ducks at three live bird markets in Hunan Province. There is an intensive on-going surveillance programme being conducted in Hong Kong SAR that covers dead wild birds, wholesale and retail market dead birds and faecal swabs and pre-sale antibody checks.

Mass vaccination against H5N1 HPAI has been implemented since November 2005 (more than 15 billion total production per year, with 5.5 billion permanent poultry population). Combined with other measures, it has succeeded in controlling the disease with an apparent reduction in the numbers of poultry outbreaks since 2004, although as mentioned above, the virus is still circulating in many provinces. Between January and September 2009, 2 845 088 post-vaccination samples were collected, of which 89.5% were seropositive.

AI vaccines are provided free of charge by the government to both commercial poultry farms and backyard poultry breeders. China produces its own AI vaccines with ten manufacturers nationwide. Most birds receive the killed Re-5 regardless of species. Most poultry should receive at least two doses of vaccine (primary + booster), except for meat ducks and chickens, which have a very short production cycle.

All the identified clades of Asian-lineage H5N1 HPAI virus found globally have been detected in China. Of particular interest is the recent expansion of Clade 2.3.2, which was originally detected from a dead Chinese pond heron in Hong Kong SAR in 2004 and has now expanded its geographic range to include Mongolia, Russian Federation, Nepal, Romania and Bulgaria. In Hong Kong SAR, viruses from Clade 2.3.4 have also been detected in wild birds and poultry in 2009.

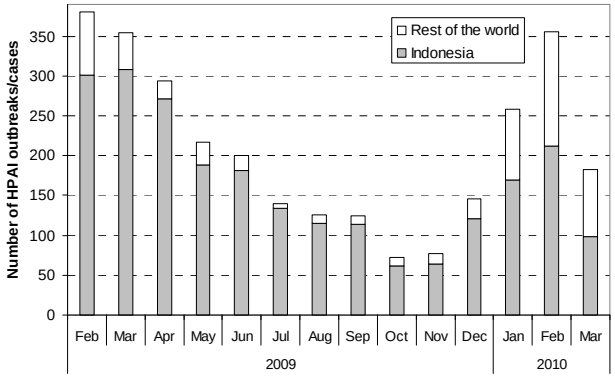
No human cases were reported during March 2010. Since the beginning of the epidemic, China has reported 38 cases, of which 25 were fatal (65.8%). On average, fewer than ten human cases are reported each year (range 0 to 13 cases annually since 2003). The latest case confirmed by WHO was a year ago, when there was a concurrent sudden increase in the number of human cases from January through early February 2009 [in Hunan (3), Beijing (1), Shandong (1), Xinjiang (1), Guizhou (1) and Guangxi (1)], including in provinces where no

poultry outbreak of viral infection had been recently or ever detected. Disease investigations carried out in the vicinity of these human cases remained inconclusive as to the origin of contamination in birds and raised questions about the existence of possible unnoticed outbreaks or asymptomatic viral excretion leading to human infection in backyard poultry farms or LBMs.

Most recently, a unique new publication by by Kou *et al.* (2010) demonstrated the H5N1 HPAI virus prevalence in apparently healthy wild bird surveyed between April 2004 and August 2007. Of 14 472 wild birds sampled, covering 56 species of 10 orders in 14 provinces of China tested with RT-PCR using H5 primers, 17 viral strains out of 149 positive samples were isolated.Of the six bird orders affected, Anseriformes had the highest prevalence (2.70%), while Passeriformes had the lowest (0.36%). Among the 24 positive species, mallard (*Anas platyrhynchos*) had the highest prevalence (4.37%). Qinghai Province had the highest prevalence (3.88%), particularly in pintails (*Anas acuta*), mallards (*Anas platyrhynchos*) and tufted ducks (*Aythya fuligula*). Sequence analysis indicated that the 17 isolated strains belonged to five clades (2.3.1, 2.2, 2.5, 6, and 7). The five isolates from Qinghai Province came all from Clade 2.2 and had a short evolutionary distance with the isolates obtained from Qinghai Province in 2005. Additional information can be found in the paper available at http://www.plosone.org/article/info:doi%2F10.1371%2Fjournal.pone.0006926.

Indonesia continues to report the majority of the H5N1 HPAI outbreaks in poultry worldwide (Figure 7), as it has for the past three years. H5N1 HPAI Clade 2.1 is confirmed to be endemic on the islands of Java, Sumatra and Sulawesi, and probably Bali, with sporadic outbreaks reported elsewhere. H5N1 HPAI prevalence by village varies widely. Only two of Indonesia's 33 provinces have never reported the occurrence of H5N1 HPAI. The high number of reports each month is partially explained by the implementation of the Participatory Disease Surveillance and Response (PDSR)1 programme that targets village poultry production systems (mainly backyard) and reports evidence of virus circulation in the village. The programme is supported by FAO with USAID, AusAID and World Bank-implemented AHIF-PHRD financial support and is operating in 349 of 496 (70%) districts through 31 Local Disease Control Centres (LDCCs) in 27 (82%) of 33 provinces in Java, Sumatra, Bali, Sulawesi and Kalimantan, including all known endemic areas. Larger and less densely-populated provinces report HPAI outbreaks less often than more densely populated provinces.

FIGURE 7
H5N1 HPAI outbreaks in poultry in Indonesia, between February 2009 and March 2010
(Source: GoI/ECTAD Indonesia)



During March 2010, PDSR officers visited 1 984 villages, of which 137 (6.9%) were infected (98 were newly found, while the remaining 39 carried over the infection status from the previous month). This infection rate was lower than the February 2010 infection rate of 16.6%, which was expected as Indonesia emerged from the usual wet season peak. During the previous 12 months, PDSR officers visited 20 117 villages (30.0%) in the 349 districts under PDSR surveillance. Since May 2008, they have visited approximately 48.5% of villages under coverage. About 10.4% of the villages visited during the previous 12 months were classified as infected. Cases over the last 12

[1] In the event that more than one bird dies suddenly in a flock, with or without clinical signs, Participatory Disease Surveillance and Response (PDSR) teams carry out an influenza type A rapid test. A mortality event consistent with clinical HPAI and a positive rapid test in affected poultry is considered a confirmed detection of HPAI in areas where HPAI has previously been confirmed by laboratory testing.

months were concentrated in North Sumatera, Lampung, and the island of Java.

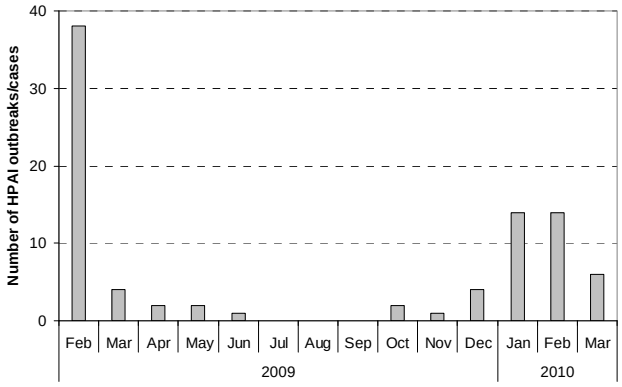
The Indonesian Government introduced vaccination in small flocks in mid-2004. Vaccines containing either an Indonesian H5N1 antigen (e.g. A/chicken/Legok/2003) or H5N2 viral antigen have been used in government programmes, and there are now approximately 20 different licensed vaccines. Vaccination programmes by the central government in the backyard poultry sector were implemented until they stopped in 2008, as a result of concern over the efficacy of registered vaccines. In the commercial sectors, vaccination is not coordinated by government, thus vaccination practices there are based on risk as perceived by the farmer. Today, preventive vaccination is practiced in all breeder facilities and on nearly all layer farms nationwide. Single dose vaccination of broilers with inactivated vaccine is practiced sporadically during the wet season on Java. Vaccination of ducks is not widely practiced and the epidemiologic role of ducks in Indonesia remains poorly understood.

No cases of human infection of H5N1 avian influenza were reported in February 2010. Of the 163 cases confirmed to date in Indonesia, 135 have been fatal (CFR=82.8%).

Myanmar, reported its first outbreaks since December 2007. For the second consecutive month, H5N1 HPAI outbreaks were reported in March 2010. On 1 March 2010, 305 laying out of 2 900 hens of different ages died on three different semi-commercial farms clustered near to each other near Monywa Town in Sagaing Division, approximately 100 km west of Mandalay. There is no epidemiological connection between this and the previous two outbreaks. Results of virus analysis of these outbreaks will be available soon.

Myanmar recently completed a national duck survey, involving over 16 000 ducks on 541 farms. The results showed that 16% of ducks were seropositive for H5, and 40% of flocks were seropositive. This suggests that the HPAI virus is endemic in duck flocks, although no virus has yet been isolated. Further tests are being conducted on the viruses isolated from the outbreaks and on the serum from the duck survey. To support ongoing disease control programmes, Myanmar is conducting a national census of commercial poultry farms, including geo-location. Based on the resurgence of outbreaks, and the findings of the duck survey, an expanded surveillance programme is being planned in 76 townships. The programme will be based on surveillance by community animal health workers and strengthening their linkages to the veterinary services, and outbreak investigations by veterinary staff. Additionally, longitudinal studies on 100 poultry flocks will be conducted, with sera collected monthly from ducks and in-contact backyard chickens.

FIGURE 8
H5N1 HPAI outbreaks in poultry in Viet Nam, between February 2009 and March 2010
(Source: FAO EMPRES-i)



In **Viet Nam**, H5N1 was first identified in poultry in 2001 and in humans in 2004. In March 2010, six H5N1 HPAI outbreaks were detected in the following provinces: Tuyen Quang, Ben Tre, Bac Ninh, Quang Ninh (2) and Bac Kan affecting mainly unvaccinated chickens and ducks. The question still remains as to where the virus hides during inter-epidemic periods in the complex and variable poultry production systems comprising chickens, ducks and rice fields. Consistent outbreak investigations are not undertaken on infected farms and key information is usually missing from the field.

Disease control measures include stamping out of infected farms, movement restrictions for 21 days, compensation (up to 70% of market value; approximately USD 1.3/bird) and vaccination. Vaccination is implemented throughout the country in two annual

campaigns (March/April and October/November), but in some areas, vaccination between the seasonal campaigns is also practiced.

Post-vaccination monitoring is routinely carried out after each vaccination campaign. For the first round of 2009, a total of 32 597 samples from 1 090 flocks were collected in 28 provinces for sero-monitoring and approximately 1 866 swab samples were taken to monitor HPAI virus circulation in slaughterhouses/slaughter points or at LBMs in 16 provinces. Results showed that approximately 58% of vaccinated birds were protected, while approximately 77% of vaccinated flocks were protected, i.e. flocks with more than 70% of birds showing protective titres HI≥ 1/16. Chicken samples showed a higher protection level of 62.29% compared with duck samples, which had a protection rate of 55.19%. However, it is likely that sampled flocks are not really selected at random from the entire poultry population, so this assessment of the vaccination programme is more a monitoring of the immune response on vaccinated flocks rather than a monitoring of the vaccine coverage.

Virus circulation surveillance (which is done at the same time as the post-vaccination monitoring) was carried out in 16 target provinces and cities. Out of 448 unvaccinated flocks (selected from slaughterhouses, slaughter points or even from households) tested, only one 500-bird duck flock in Soc Trang Province tested positive for H5N1 virus.

Surveillance for AI is a component of numerous projects:
ACIAR (Australian Centre for International Agricultural Research) project started in June 2006 for three years and includes longitudinal studies to determine the prevalence of past and present infection in smallholder farms in the Mekong River Delta–South Viet Nam (ongoing).
NZAID (New Zealand's International Aid & Development Agency) project will run for two years and includes longitudinal studies on nomadic ducks in the Mekong River Delta–South Viet Nam (ongoing).
CIRAD (French Agricultural Research Centre for International Development) project started in 2007 and includes epidemiological studies in the Red River Delta–North Viet Nam (ongoing).
VAHIP (Vietnam Avian and Human Influenza Control and Preparedness Project) project is being funded by the World Bank for three years and includes various surveillance activities, including market surveillance for virus circulation and outbreak investigations (ongoing).
A new cycle of the USAID (United States Agency for International Development) project by FAO Viet Nam was launched in September 2009 in five new pilot provinces with a surveillance component focusing on enhancing the reporting system, strengthening the outbreak investigation and response, and developing an active surveillance model at commune level with local USAID partners.

Based on the monitoring of surveillance activities, four currently circulating virus clades have been isolated: (1) HA Clade 1 (predominant in southern Viet Nam and also isolated in Cambodia); (2) HA Clade 2.3.4 (predominant in northern Viet Nam and also circulating in China); (3) HA Clade 7 (detected in poultry seized at the Chinese border and at markets near Hanoi); and (4) there is evidence for incursion of Sub-Clade 2.3.2 in 2009. In 2009, ten viruses isolated from poultry outbreaks were sent to the U.S. Centers for Disease Control and Prevention (CDC) for sequencing.

In March 2010, three human cases were reported in a three-year old girl from Binh Duong Province (fatal), a 25-year old woman from Hanoi, and a 22-year old male from Bac Kan province. Of the 118 cases confirmed to date in Viet Nam, 59 have been fatal (CFR = 50%).

Middle East

In **Israel**, after the isolated H5N1 HPAI outbreak on a commercial farm in Haifa Province, no further outbreaks were reported in February 2010. The previous H5N1 outbreak in Israel, in late December 2007, had involved a single, small backyard pet-bird holding, very

close to the January 2010 outbreak. Israel maintains intensive avian influenza surveillance.

Europe

In **Bulgaria**, a common buzzard (*Buteo buteo*) found dead on 29 March 2010 in the Konstantin and Elena Resort, Varna District, by the Black Sea coast, tested positive for H5N1 HPAI virus. The previous outbreak/case in Bulgaria dates from May 2006.

In **Romania**, an outbreak of HPAI H5N1 was reported in March 2010 in backyard poultry in Letea, Tulcea County. Letea is a small locality in the north-eastern part of the Danube Delta, close to the border with Ukraine. The locality is isolated by water and accessible by boat. The disease started on 13 March 2010, when two birds died in two backyards with a population of 47 birds. The source of infection is believed to be contact with wild species. A second outbreak was reported a few days later (27 March 2010) in Plaur Village, also in Tulcea Country, and only 55 km from the previous outbreak. Out of 80 backyard hens, 28 were found dead and 52 were sick. The previous outbreak in Romania was observed in December 2007, also in Tulcea County.

Phylogenetic analyses of the HA gene revealed that both the Romanian and the Bulgarian isolates, from backyard chickens and common buzzard, respectively) grouped in 2010 Clade 2.3.2 and were 99.3% equal to each other and 99.3% similar to viruses isolated recently from poultry in Nepal.

Prior to March 2010, the last H5N1 HPAI event in poultry had been detected in October 2008 on a mixed poultry farm in Germany and the last H5N1-positive wild bird was a rock dove reported in October 2009 in the Russian Federation.

Non-infected countries/territories

There have been no HPAI outbreaks reported in **Australia, New Zealand**, the **Pacific Community**, **Papua New Guinea** (outbreaks have occurred in the Indonesian province of West Papua) or **the Philippines**. To date, no outbreaks have been reported in **Timor-Leste**, but here surveillance capacity is weak. In South Asia, **Sri Lanka** and the **Maldives** have not experienced disease. Some Asian countries regularly report negative results obtained from their surveillance activities and suspected cases.

Iraq, where the last H5N1 HPAI outbreak was in February 2006, reported recent laboratory results of their surveillance activities for January 2010 for all governorates except Kurdistan Province, in the north of the country. All samples taken on poultry farms (330), backyard poultry (1 504), game and wild birds (0), and markets and slaughterhouses (148) were negative for H5N1. A market tested positive for H9 in Basrah Governorate.

Between August and December 2009, the HPAI Surveillance Guidelines for Backyard and Free Range Poultry Farming Systems, developed by FAO with the financial support of USAID, were applied in four selected countries from the Southern African Development Community (SADC), which had never reported HPAI: **Malawi, Mozambique, Zambia**, and **Zimbabwe**. Table 1 summarizes the results. All samples collected tested negative. There will be an extension of the surveillance activities for 2010 (March-September) using the same sampling framework.

TABLE 1
AI surveillance activities took place in four selected Southern African Development Community (SADC) countries between August and December 2009

	Serum	Tracheal swabs	Cloacal swabs
Malawi			
Sector 3	880	421	-
Sector 4	1934	1750	1805
LBMs	981	550	-
TOTAL	**3795**	**2721**	**1805**
Mozambique			
TOTAL	**2132**	**457**	**-**
Zambia			
TOTAL	**1738**	**2133**	**-**
Zimbabwe			
Sector 3	3086	9	-
Sector 4	3729	15	-
Border posts	165	-	-
TOTAL	**7980**	**24**	**-**

In **Nigeria**, there have been no reported cases of H5N1 HPAI since July 2008. From 2006 to date, the number of positive cases remains 300. A surveillance study, expected to have started before the end of 2009, will aim to establish the baseline for the duck population in a specified region, to understand the production systems, market chains and disease transmission risk factor among domestic and wild birds. This programme will be financially supported by the Avian Influenza Control programme assisted by the World Bank. In addition, wild bird capture and sampling organized by FAO was successfully completed at the Dagona Wild Bird Sanctuary, with the participation of the Wildfowl & Wetlands Trust (WWT) and the support of the Nigerian Ministries of Agriculture and Environment.

Expanded active surveillance in selected LBMs in all the states of Nigeria conducted by the National Animal Disease Information and Surveillance/Avian and Human Influenza Pandemic Preparedness Control Project (AICP/NADIS) and the National Veterinary Research Institute (NVRI) is underway. As for December 2009, 18 419 samples were collected and received, 10 587 samples have been analyzed and so far no avian influenza virus has been detected. One hundred and twenty-eight isolates of Newcastle disease virus were obtained.

In addition, there is a surveillance plan in operation at cross-border markets and sector 3 commercial farms for H5N1 (as well as at pig farms for H1N1) under the Support Programme to Integrated National Action Plans for Avian and Human Influenza (SPINAP-AHI) project. The field activities will start in April 2010 on all registered poultry and pig farms (recently compiled under the SPINAP project).

CONCLUSIONS

Since 2003, 63 countries/territories have experienced outbreaks of H5N1 HPAI. The last newly infected country was Bhutan in February 2010 (Figure 9 – upper right corner). Effective control measures for outbreaks in poultry have been associated with reduced incidence of human infections in several countries. However, H5N1 HPAI remains entrenched in poultry in parts of Asia and Africa (Egypt) and thus the risk of human infection remains.

The number of countries reporting outbreaks was less in 2009, when compared with 2008, 2007 and 2006 (Figure 9 – upper right corner). However, the number of affected countries between January and March 2010 already equals the number of affected countries for the whole of 2009. The total number of outbreaks reported (Figure 10 – upper right corner) shows a similar, but more pronounced, trend. Also, the total number of outbreaks between January

FIGURE 9
Number of countries by continent and by month and year that reported H5N1 HPAI outbreaks since December 2003
(Source: FAO EMPRES-i)

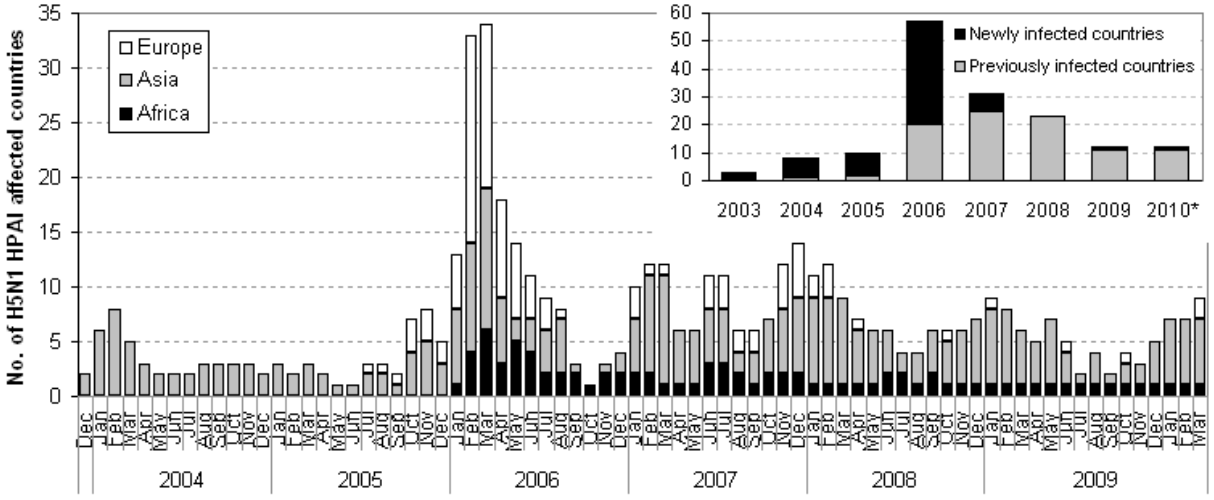
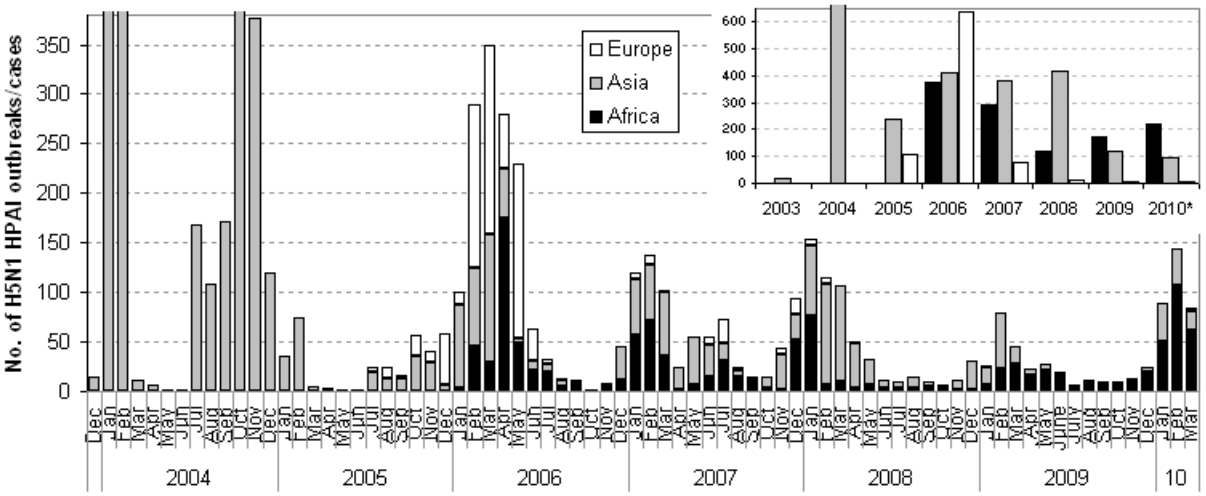


FIGURE 10

H5N1 HPAI outbreaks/cases by continent, by month, since December 2003

(Source: FAO EMPRES-i; Note 1: Indonesia data are not included, because the epidemiological unit definition for the PDSR data was modified from household level to village level in May 2008 and is not comparable); Note 2: Months with more than 380 outbreaks (Jan 0 1,311, Feb 04: 1,175 and Oct 04: 741), and years with more than 650 outbreaks (2004 in Asia: 4,189) have been truncated so that rest the graph is not distorted)



and March 2010 already surpasses the number of outbreaks for the whole of 2009, 317 *vs.* 297. Nevertheless, the number of reported outbreaks is a more subjective indicator than the number of affected countries, because it is highly influenced by variables such as the case definition used, the awareness level, the intensity/effectiveness of surveillance programmes in countries and the willingness to report. Although there has been an improvement in disease awareness, outbreaks/cases of H5N1 HPAI are still likely to be under-estimated and under-reported in some regions because of limitations in the capacity of veterinary services to implement sensitive and cost-effective disease surveillance, the lack of proper outbreak investigations in the field, and the absence or weakness of compensation schemes.

Data from previous years have shown a peak in the number of outbreaks/cases during the January-March period in terms of countries affected (Figure 9), number of reported outbreaks (Figure 10) and also human cases (Figure 3). While February 2010 still constitutes the peak so far this season in terms of the number of outbreaks reported (Figure 10), the peak in terms of number of countries affected was reached in March 2010 (Figure 9). Overall, there is a decreasing trend in the height of the peak as years go by. However, in terms of number of outbreaks (Figure 10), and against the decreasing trend observed since 2004, the peak height reached dimensions similar to the peaks of 2006-2007 and 2007-2008, and considerably higher than the 2008-2009 peak. This is explained by the higher contribution of Africa (Egypt) to the total number of outbreaks (Figure 10), because of the implementation of a more intensive surveillance programme (CAHO), together with the fact that vaccination of backyard poultry was stopped in July 2009. It may also be related to a reduction in the efficacy of control programmes (fatigue).

During 2010, H5N1 HPAI has re-surfaced in several countries where the disease was believed to have been eliminated (without vaccination): Cambodia, Israel, Myanmar, Nepal, Romania and Bulgaria. It is still too early to evaluate whether these are re-introductions, where wild birds and hunting/poaching play a significant role, or whether the virus was circulating undetected by surveillance programmes. In the cases of Bangladesh and India, that had reported no outbreaks in the second half of 2009, a new wave of cases has been observed since the beginning of 2010.

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EMPRES welcomes information on disease events or surveillance reports on H5N1 HPAI (and other TADs), both rumours and official information. If you want to share any such information with us, please send a message to glews@fao.org.

SUMMARY OF CONFIRMED HPAI OUTBREAKS

(as of 15 May 2010)

Sources: OIE, European Commission (EC), FAO and national governments – WHO for human cases/deaths

Note: H5N1 unless otherwise indicated. Highlighted countries indicate those in which there has been only one officially confirmed H5N1 outbreak or occurrence. Dates of the last outbreak within this year are in bold.

AFRICA	First outbreak	Latest outbreak	Animals affected to date	Human cases / deaths to date
Benin	7 November 2007	15 December 2007	Domestic poultry	-
Burkina Faso	1 March 2006	20 May 2006	Domestic poultry - wild birds	-
Cameroon	21 February 2006	28 March 2006	Domestic poultry – wild birds	-
Côte d'Ivoire	31 March 2006	31 January 2007	Domestic poultry – wild birds	-
Djibouti	6 April 2006	6 April 2006	Domestic poultry	**1 / 0**
Egypt	17 February 2006	**5 May 2010**	Domestic poultry – wild birds – donkeys*	**108 / 33**
Ghana	14 April 2007	13 June 2007	Domestic poultry	-
Niger	6 February 2006	1 June 2006	Domestic poultry	-
Nigeria	16 January 2006	22 July 2008	Domestic poultry – wild birds	**1 / 1**
Sudan	25 March 2006	4 August 2006	Domestic poultry	-
Togo	6 June 2007	8 September 2008	Domestic poultry	-

ASIA	First outbreak	Latest outbreak	Animals affected to date	Human cases / deaths to date
Afghanistan	2 March 2006	2 October 2007	Domestic poultry – wild birds	-
Bangladesh	5 February 2007	**31 March 2010**	Domestic poultry	**1 / 0**
Bhutan	**18 February 2010**	**14 March 2010**	Domestic poultry	-
Cambodia	12 January 2004	**22 April 2010**	Domestic poultry – wild birds	**10 / 8**
China	20 January 2004	27 May 2009	Domestic poultry – wild birds	**38 / 25**
China (Hong Kong SAR)	19 January 2004	**26 March 2010**	Wild birds	-
India	27 January 2006	**30 January 2010**	Domestic poultry	-
Indonesia	2 February 2004	**January 2010**	Domestic poultry – pigs (with no clinical signs)	**165/ 136**
Japan	28 December 2003	7 May 2009 (raccoons, seropositive)	Domestic poultry – wild birds – raccoons (with no clinical signs)	-
Kazakhstan	22 July 2005	10 March 2006	Domestic poultry – wild birds	-
Korea, Rep. of	10 December 2003	12 May 2008	Domestic poultry – wild birds	-
Lao PDR	15 January 2004	**27 April 2010**	Domestic poultry	**2** / **2**
Malaysia	7 August 2004	2 June 2007	Domestic poultry – wild birds	-
Mongolia	10 August 2005	**3 May 2010**	Wild birds	-
Myanmar	8 March 2006	**1 March 2010**	Domestic poultry	**1 / 0**
Nepal	8 January 2009	**8 March 2010**	Domestic poultry	-
Pakistan	23 February 2006	17 June 2008	Domestic poultry – wild birds	**3 / 1**
Thailand	23 January 2004	10 November 2008	Domestic poultry – wild birds – tiger	**25 / 17**
Viet Nam	9 January 2004	**13 May 2010**	Domestic poultry	**119/ 59**

NEAR EAST	First outbreak	Latest outbreak	Animals affected to date	Human cases / deaths to date
Iran	2 February 2006	10 December 2007	Domestic poultry - wild birds	-
Iraq	18 January 2006	1 February 2006	Domestic poultry – wild birds	**3 / 2**
Israel	16 March 2006	**29 April 2010**	Domestic poultry – Emu (zoo)	-
Jordan	23 March 2006	23 March 2006	Domestic poultry	-
Kuwait	23 February 2007	20 April 2007	Domestic poultry – wild birds - zoo birds	-
Saudi Arabia	12 March 2007	29 January 2008	Domestic poultry	-
West Bank & Gaza Strip	21 March 2006	2 April 2006	Domestic poultry	-

* Journal of Biomedical Science : http://www.jbiomedsci.com/content/17/1/25

EUROPE	First outbreak	Latest outbreak	Animals affected to date	Human cases / deaths to date
Albania	16 February 2006	9 March 2006	Domestic poultry	-
Austria	10 February 2006	22 March 2006	Wild birds – cats	-
Azerbaijan	2 February 2006	18 March 2006	Wild birds – domestic poultry – dogs	**8 / 5**
Bosnia-Herzegovina	16 February 2006	16 February 2006	Wild birds	-
Bulgaria	31 January 2006	**29 March 2010**	Wild birds	-
Croatia	21 October 2005	24 March 2006	Wild birds	-
Czech Republic	20 March 2006	11 July 2007	Wild birds – domestic poultry	-
Denmark	12 March 2006	22 May 2006	Wild birds – domestic poultry	-
France	17 February 2006	14 August 2007	Wild birds – domestic poultry	-
Georgia	23 February 2006	23 February 2006	Wild birds	-
Germany	8 February 2006	10 January 2009 mallard, wild	Wild birds – domestic poultry – cats – stone marten	-
Greece	30 January 2006	27 March 2006	Wild birds	-
Hungary	4 February 2006	23 January 2007	Wild birds – domestic poultry	-
Italy	1 February 2006	19 February 2006	Wild birds	-
Poland	2 March 2006	22 December 2007	Wild birds – domestic poultry	-
Romania	7 October 2005	**27 March 2010**	Wild birds – domestic poultry – cat	-
Russian Federation	15 July 2005	26 October 2009 rock dove	Domestic poultry – wild birds	-
Serbia	28 February 2006	16 March 2006	Wild birds – domestic poultry	-
Slovakia	17 February 2006	18 February 2006	Wild birds	-
Slovenia	9 February 2006	25 March 2006	Wild birds	-
Spain	7 July 2006	9 October 2009 (H7)	poultry	-
Sweden	28 February 2006	26 April 2006	Wild birds – domestic poultry - game birds - mink	-
Switzerland	26 February 2006	22 February 2008	Wild birds	-
Turkey	1 October 2005	9 March 2008	Domestic poultry – wild birds	**12 / 4**
Ukraine	2 December 2005	11 February 2008	Wild birds – domestic poultry – zoo birds	-
United Kingdom	30 March 2006	22 May 2008 (H7N7)	Wild birds – domestic poultry	-