FAOAIDEnews
Animal Influenza Disease Emergency

**Situation Update 69**
2 September 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.*

# Risk factors of highly pathogenic avian influenza outbreaks in domestic poultry

Since late 2003, 62 countries around the world have reported cases of highly pathogenic avian influenza H5N1 (H5N1 HPAI) in poultry and wild birds. Up to September 2010, the cumulative number of confirmed human cases of H5N1 HPAI reported to the World Health Organization is 504, of which 299 have resulted in death.

The H5N1 HPAI global disease situation is now relatively stable, but still alarming in some countries where the disease is considered entrenched. In these locations, pockets of infections are closely associated to well-known risk factors, such as high human and chicken densities, large free-grazing duck populations, poor biosecurity in smallholder units and culturally-determined food market habits linked to poor poultry hygiene.

In 2007, the use of spatial cluster analysis revealed the presence of more specific risk factors supporting the spread of infections in selected geographical clusters, such as the higher percentage of surface water which would support higher densities of domestic and wild water birds compared with other adjacent regions.

For instance, in Southeast Asia the presence of agro-livestock farming systems involving the combination of paddy rice production, domestic water birds and poultry in the river deltas is ubiquitous. These specific mixtures of factors are likely to be important for maintenance of infection given that H5N1 HPAI thrives in the presence of water, bird faeces, ducks and chickens. More recently, a study published in the *International Journal of Infectious Diseases* found that two risk factors –poultry density and road density– had a statistically significant correlation with the number of H5N1 HPAI outbreaks in poultry at district levels in West Java Province, Indonesia.

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

Both the medical and veterinary professions recognize the vital roles played by identifying and understanding disease risk determinants. Such knowledge underpins a multilayered approach to proactive disease risk management; one that combines the interlocking elements of foresight, prevention, impact mitigation, early detection, and swift and effective reaction.

To accomplish its mandate of achieving food security for all, the Food and Agriculture Organization of the United Nations (FAO) is undertaking various studies to better understand the root causes that underpin pathogen evolution, establishment and persistence. These studies could potentially reveal viable options to address high-impact transboundary diseases that are emerging and re-emerging globally, thereby affecting animal and human health.

## The spread of wild bird vectored avian influenza H5N1 in Europe enhanced during cold winters

Since the onset of highly pathogenic avian influenza H5N1 (H5N1 HPAI) epidemics in late 2003 a total of 62 countries or territories have reported cases of this disease in poultry and wild birds. Of these, 26 are located in Europe. Particularly in eastern Asia and Egypt does this zoonotic disease remains detrimental to animal and human health, with significant impacts on food security, economic progress, social stability and livelihoods.

A direct relationship between cold weather and the incidence of influenza has since long been established. In January 2006, a major cold spell affected Europe, coinciding with an increase of H5N1 HPAI detected in wild birds, mostly dead mute swans, starting along the River Danube and the Mediterranean coast line. In subsequent weeks H5N1 HPAI detections in wild birds were concentrated in central and western parts of Europe, reaching a peak in mid February 2006.

An FAO research team investigated whether the geographic distribution of these H5N1 HPAI infections was modulated by the long-term wintering line, that is, the zero degree Celsius isotherm marking the limit beyond which areas are largely unsuitable for wintering waterfowl. This analysis shows that H5N1 HPAI detection sites were closer to the wintering line than would be expected by chance.

The rationale is that partial frost conditions in water bodies in wild bird wintering areas throughout Europe are conducive to bird congregation, enhancing H5N1 HPAI transmission and local spread. H5N1 HPAI hotspots build up environmental virus loads so that the virus may locally persist until spring, at least in cooler areas proximate to the wintering line.

The practical implication of this finding is that anomalous cold weather periods would therefore represent a warning signal for authorities to step up wild bird influenza surveillance in European wintering sites.

More about these findings and other details in relation to this topic can be found in 'The Cold European Winter of 2005–2006 Assisted the Spread and Persistence of H5N1 Influenza Virus in Wild Birds' published in EcoHealth journal, August 2001.

The Food and Agriculture Organization of the United Nations (FAO) undertakes this type of study in order to reveal feasible and viable options to address high-impact transboundary diseases that are emerging and re-emerging around the world.

# MOST RECENT H5N1 AI OUTBREAKS 2006-2010

Note: This list has been compiled on the basis of information up to 31 August 2010.

## 2010

| | |
|---|---|
| **August** | Egypt |
| **July** | Viet Nam |
| **June** | Bangladesh, Indonesia, Russian Federation |
| **May** | China, Israel, **Mongolia** |
| **April** | Cambodia, Lao PDR |
| **March** | Bhutan, **Bulgaria**, China (Hong Kong), Myanmar, Nepal, Romania |
| **January** | India |

## 2009

| | |
|---|---|
| **March** | Germany |

## 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

# AT A GLANCE

*The latest HPAI outbreaks for the period 1 – 31 August 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 13 H5 HPAI positive cases were reported in seven governorates during 1 - 31 August: Beni Suef (3), Dakahlia (3), Gharbia (1), Giza (1), Kafr el Sheikh (1), Menoufia (3) and Qena (1) Governorates (The number of outbreaks in the governorate is in brackets). All of the outbreaks were in household poultry, except for one commercial farm in the Kafr-el-Sheikh Governorate. There were also two human cases of H1N5 infection confirmed in Cairo and Qalioubiya Gov the case had exposure to sick and dead poultry. ernorates during the same period, the case in Cairo had exposure to sick and dead poultry.

## ASIA

### INDONESIA

The Participatory Disease Surveillance & Response (PDSR) programme through 33 Local Disease Control Centres covers 71,038 villages in 84% of Indonesia's 448 districts and municipalities in 29 of its 33 provinces. During June 2010, PDSR conducted surveillance in 1,780 villages (2.5%). The overall HPAI incidence was 0.4 infected villages per 1000 villages under surveillance. The disease incidence did not vary very much as only a few provinces reported new infected villages. The provinces with the highest incidence values was Yogyakarta (6.8 per 1000 villages). The number of newly infected villages found during June by island was: 5 in Sumatra, 23 in Java, 1 in Kalimantan and Sulawesi.

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 May 2010, 83 H5N1 HPAI poultry outbreaks were observed in Bangladesh, Egypt, Indonesia and Viet Nam. Outbreaks in wild birds were reported in China and Mongolia. In June 2010, 55 H5N1 HPAI poultry outbreaks were observed in Bangladesh, Egypt, Indonesia and Viet Nam. An outbreak in wild birds was reported in the Russian Federation. The number of reported outbreaks/cases by country and their location are illustrated in Figures 1 and 2, respectively.

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

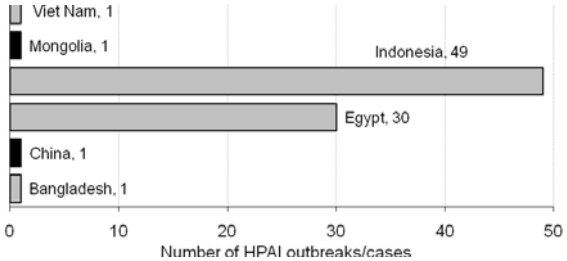



**FIGURE 1b**
H5N1 HPAI outbreaks/cases in poultry/wild birds in June 2010
*(Source: FAO EMPRES-i)*

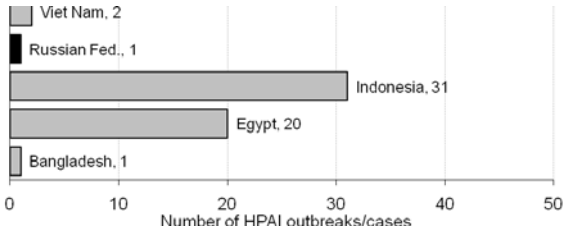



**FIGURE 2**
H5N1 HPAI outbreaks/cases reported in poultry, wild birds and humans in May and June 2010
*(Source: FAO EMPRES-i)*


**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 June 2010, 500 human cases of H5N1 infection were reported to WHO from 15 countries, of which 296 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% (137 out of 166). 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=478). Cases between 0 and 9 years of age were most common (29%). 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 (245/471). (Source: Western Pacific Regional Office of WHO, Avian Influenza Update).

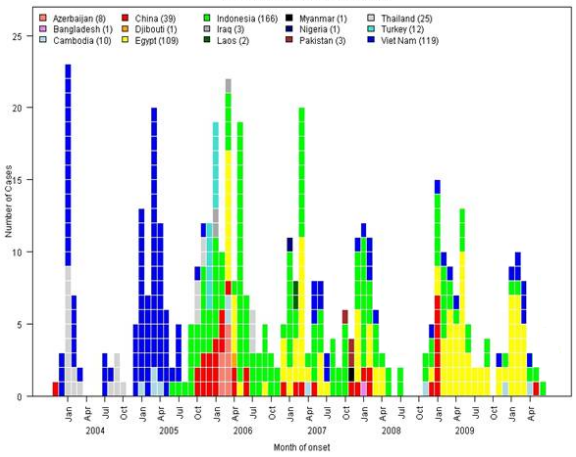
**TABLE 1**
Cumulative number of confirmed human cases of avian influenza A/H5N1 reported to WHO
*(Source: World Health Organization - WHO)*

| Country | 2008 | | 2009 | | 2010 | |
|---|---|---|---|---|---|---|
| | cases | deaths | cases | deaths | cases | deaths |
| Bangladesh | 1 | 0 | 0 | 0 | 0 | 0 |
| Cambodia | 1 | 0 | 1 | 0 | 1 | 1 |
| China | 4 | 4 | 7 | 4 | 1 | 1 |
| Egypt | 8 | 4 | 39 | 4 | 19 | 7 |
| Indonesia | 24 | 20 | 21 | 19 | 5 | 4 |
| Viet Nam | 6 | 5 | 5 | 5 | 7 | 2 |
| **Total** | **44** | **33** | **73** | **32** | **33** | **15** |

In 2009, although the number of cases increased in 65% when compared to 2009, CFR decreased from 75% to 44%. This is mainly explained by the high number of non-

fatal cases reported in Egypt. In 2010, as of 30 June, 33 human cases had occurred, with a 45% CFR.

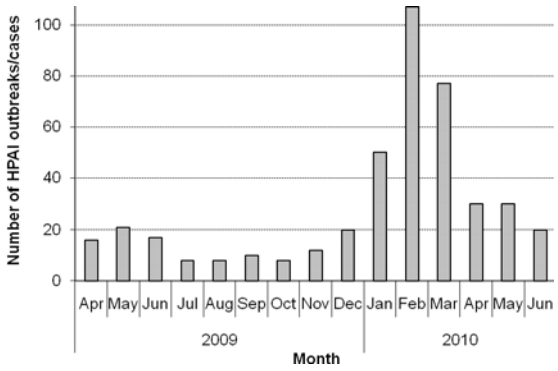
**FIGURE 3**
Cases of H5N1 AI infections reported in humans by country and month of onset since November 2003
*(Source: World Health Organization - WHO)*




## SITUATION BY CONTINENT/REGION

### Africa

**FIGURE 4**
H5N1 HPAI poultry outbreaks in Egypt between April 2009 and June 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 May and June 2010, 50 H5 HPAI outbreaks were reported in poultry (chickens and turkeys) from Aswan (1), Behaira (1), Beni Suef (1), Dakahlia (6), Damietta (1), Fayoum (6), Gharbia (4), Helwan (3), Luxor (3), Minufiyah (7), Port Said (1), Qalubia (2), Qena (2), Sixth October (8), Suez (2) and Sharkia (2) governorates. Of these, 47 outbreaks (94%) were reported from the household poultry sector. 49 outbreaks occurred in non-vaccinated birds (98%) and the remaining one (2%) occurred in vaccinated birds. During the reporting month, Community Animal Health Outreach (CAHO) teams visited 176 villages in fifteen governorates and detected eight (16%) 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 May and June 2010, 6000 samples were collected for this purpose, of which one sample from Gharbia governorate was confirmed positive for HPAI. In Egypt, compliance with certification for poultry transportation is generally sub-optimal, and only registered farms (<20 % of the farms) seek such services.

During May and June 2010, 56 poultry farms in 10 governorates were subjected to active surveillance and one was confirmed positive for H5 HPAI infection. Active surveillance was also carried out in 243 villages and 32 samples from 11 governorates were confirmed positive for H5 HPAI.

By way of passive surveillance, one of two HPAI notifications received from commercial poultry farms was found positive for H5 HPAI. In addition, 15 of the 131 suspected outbreak notifications received from 10 governorates were confirmed positive for H5 HPAI. 133 samples collected at road check points were found negative for H5 HPAI.

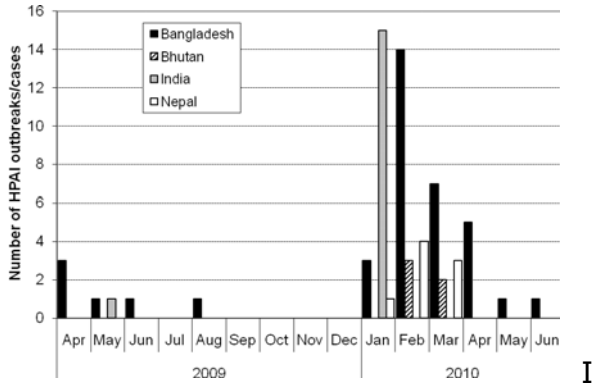
The current government policy is to allow commercial poultry farms to vaccinate their flocks with registered vaccines of their choice. Although there are no official data, it is assumed that vaccines are widely used in the commercial poultry sector. All AI vaccines used in Egypt (at least 21) are inactivated (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, after an assessment

suggested that the programme had limited or no impact on H5N1 HPAI incidence.

In May and June 2010, no human avian influenza A H5N1 cases were reported. 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 reported in 2010 have been in patients over that age. The case fatality rate (CFR) in 2010 is 37% while it was 10% in 2009, and 50% in 2008. The increase in reported H5N1 HPAI outbreaks in poultry (264 in 2010 compared with 71 in the same period in 2009) is most likely the result of improved surveillance through the effectiveness of the CAHO programme.

## South Asia

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




During May and June 2010, **Bangladesh** experienced two outbreaks in layer farms in Bogra and Narayanganj. Viral samples, including three samples isolated in January 2010, were sequenced by the FAO/OIE 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 30 June 2010, a total of 357 outbreaks had been recorded in 47 out of 64 districts, which include 30 outbreaks in 2010, 32 in 2009, 226 in 2008 and 69 in 2007. Out of these outbreaks, 303 were in commercial poultry farms, and only 54 in backyard poultry. Over 1.8 million birds have been culled since 2007. 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, regardless of the presence or absence of disease and deaths in poultry. SMS messages of suspected AI events are automatically forwarded to the livestock officer in the area, who will start an investigation. In May and June, 21 379 and 21 013 SMS messages were received, respectively, including 164 suspected HPAI events in backyard poultry and 456 suspected events in commercial poultry farms. The veterinary investigations that followed excluded 612 of these suspect cases and on 60 occasions diagnostic specimens were collected. Of all specimens collected and reported through the SMS gateway system, two tested positive for H5N1 HPAI.

Eight of 23 migratory waterfowl trapped in Bangladesh as part of an FAO-facilitated satellite tracking project in February 2010, are still delivering data. Movements of these birds over the Himalayas into China and Mongolia for summer breeding grounds has provided valuable insight into migratory pathways and their role in the global spread of avian influenza viruses. This way, objective and verifiable evidence will be available to further elucidate the role of migratory birds in the

spread of H5N1 HPAI. An article on this project has been published in Science Vol 328 (April 2010), page 553 (http://www.sciencemag.org/content/vol328/issue5978/r-samples.dtl). Information on the current location of the birds at http://www.werc.usgs.gov/Project.aspx?ProjectID=159.

In **Bhutan**, after outbreaks reported in February and March 2010 (the first outbreaks ever reported in the country), no outbreaks have been detected in subsequent months. The disease was controlled by culling affected and in-contact poultry, burning coops, disinfection and disposal of culled birds and poultry products by burial. Phylogenetic analysis confirmed Clade 2.2, similar to the viruses detected in India and Bangladesh.

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 have been observed since then. The 2010 virus isolates are similar to those of 2008 and 2009: Clade 2.2.

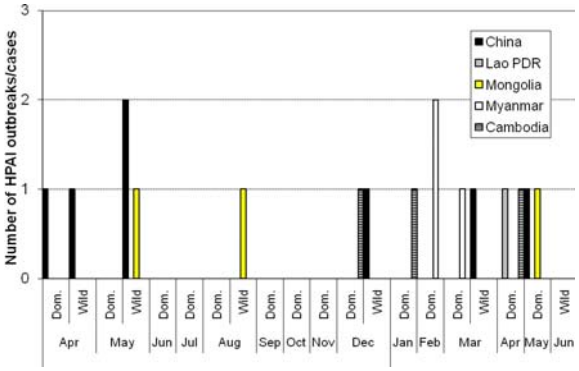
According to the last surveillance between 25 April and 4 July 2010, 12 761 active surveillance samples were received at the High Security Animal Disease Laboratory (HSADL), Bhopal. Testing was completed on 14 609 samples (some from the previous month), all with negative results, and another 1 897 were under test or pending. The periodical reports (available at http://www.dahd.nic.in/) include the number of samples received and tested per state. In addition, the Ministry of Environment and Forests Government of India and Department of Wildlife and Forests Uttar Pradesh are funding the sampling of wild water birds. The session 2009-2010 started on 25 November 2009 and was implemented by the Bombay Natural History Society and the Aligarh Muslim University. Trapping and ringing started from Sheikha Jheel, Aligarh. In total, 2 258 samples (serum, oral and cloacal swabs) from 59 waterbird species were collected and sent to HSADL for analysis. Results are pending.

Twelve of sixteen migratory waterfowl trapped in the states of Assam and West Bengal as part of an FAO-facilitated satellite tracking project in January 2010, are still delivering data. Movements of these birds over the Himalayas into China and Mongolia for summer breeding grounds has provided valuable insight into migratory pathways and their role in the global spread of avian influenza viruses. (http://www.fao.org/avianflu/en/wildlife/sat_telemetry_india.htm). Laboratory results are still pending.

In **Nepal**, no H5N1 HPAI outbreaks have been reported since March 2010. 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, which is the first detection of this clade in the South Asia region. Clade 2.2 had been already isolated in 2009 in Nepal's eastern region. Clade 2.3.2 viruses were most related to viruses isolated in wild birds in 2009 from the Russian Federation and Mongolia. 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 April 2009 and June 2010
*(Source: FAO EMPRES-i)*




In **Cambodia** no additional poultry or human cases have been reported since April, when a 27-year old man from Prey Veng Province died of H5N1 infection. In Cambodia, human cases have alerted authorities to poultry outbreaks – in effect, humans are acting as sentinels for avian disease.There is still no information about the clade, but 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 until February 2010) at the National Veterinary Research Institute (NaVRI). There is also ongoing duck market surveillance at eight live bird markets in five provinces and sentinel duck flocks surveillance in six provinces, both conducted by NaVRI (and supported by FAO). As none of the samples previously collected from 12 markets during two years have tested positive for H5N1 HPAI, the number of markets was reduced to eight and, in addition, 12 sentinel duck flocks have been introduced into the surveillance program.

In **China**, an outbreak was observed in wild birds in Shuanghu District in Tibet. It started on 9 May 2010. A total of 170 wild birds were found dead, including 141 brown-headed gulls (*Larus brunnicephalus*), 27 bar-headed geese (*Anser indicus*), one red-billed chough (*Pyrrhocorax pyrrhocorax*) and one Eurasian wigeon (*Anas penelope*).

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), showing a decrease in the number of outbreaks reported since the beginning of the epidemic in 2004. However, official ongoing surveillance activities conducted at national and provincial levels provided evidence that H5N1 viruses were still circulating in many provinces. Out of 217 052 virological samples collected between November 2009 to January 2010, 47 H5N1 viruses in ducks (57.4%), chickens (40.4%) and geese (2.1%) were detected in Anhui, Chongqing, Fujian, Guangdong, Guangxi, Guizhou, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Sichuan, Yunnan and Zhejiang. Sixty-five percent of all virological samples were collected from chickens, 18% from ducks, 6% from geese and 3% from wild birds, the remaining 8% being collected from pigs and other species. In a number of provinces, the proportion of positive samples was higher than expected, especially for ducks (some over 4%). However, sample sizes were small.

The results from the national surveillance system were released in June 2010 by the Ministry of Agriculture and covered the months of December 2009 and January 2010. In the first bulletin (samples collected in December 2009) 9 virus were detected in chickens (5) and ducks (4) in Hunan and Yunnan from 146 778 poultry samples collected. In the second bulletin (samples collected in January 2010), 38 H5N1 HPAI viruses were isolated from 21 892 poultry samples. These viruses were detected in

chickens, ducks and goose in 29 live bird markets in 13 provinces.

An intensive, surveillance programme currently ongoing in Hong Kong SAR includes sampling of dead wild birds, wholesale and retail market birds found dead, as well as faecal swabs and pre-sale antibody checks from healthy birds.

China has an enormous poultry sector, with more than 15 billion total production per year and 5.5 billion permanent poultry population. Mass vaccination against H5N1 HPAI has been implemented since November 2005. Combined with other measures, it has resulted in an improved disease control. Although the virus is still circulating in many provinces, there has been an apparent reduction in the number of poultry outbreaks since 2004. Between November 2009 and January 2010, out of 1 413 300 post-vaccination samples, 1 247 797 (88.29%) 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 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.

A 22-year old pregnant female from Hubei Province diagnosed with H5N1 influenza A after becoming ill on 23 May 2010, died on 3 June 2010. Investigations into the source of her infection indicate exposure to sick and dead poultry, although no poultry outbreak was reported. Since the beginning of the epidemic, China has reported 39 human cases, of which 26 (67%) were fatal. On average, fewer than ten human cases are reported each year (range is from 0 to 13 cases annually since 2003). From January through early February 2009, eight human cases were reported 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 infection in birds and raised questions about the existence of possible unreported outbreaks or asymptomatic viral excretion leading to human infection in backyard poultry farms or LBMs.

Most recently, a unique new publication by Kou *et al.* (2010) demonstrated the H5N1 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 (2.2, 2.3.1, 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.

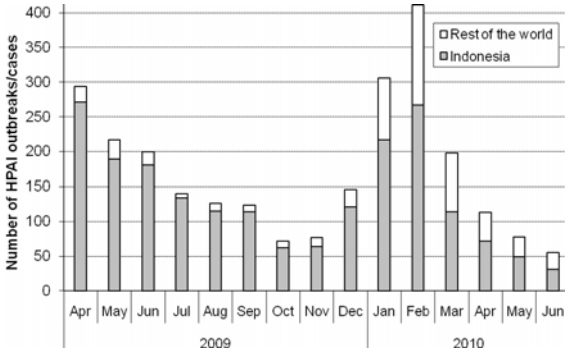
A paper by Jiang *et al* (2010) reports on 1) the apparent shift towards Clade 2.3.2 viruses as the 'dominant' clade in 2009; 2) the continuing evolution of Clade 7 and Clade

2.3.4 viruses; 3) some changes in the antigenicity of Clade 7 and (to a lesser extent) Clade 2.3.2 viruses; 4) multiple sub-lineages forming within Clade 2.3.2 and 2.3.4; and 5) the detection of Clade 2.3.4 viruses in Xinjiang. A significant number of these viruses were detected in chickens in backyard flocks and markets. The viruses were detected in each round of testing in Guangdong. As antigenic drift of the H5N1 virus continues, it will be necessary to monitor these changes and perhaps develop new vaccine antigens. Additional information can be found on the original paper at http://vir.sgmjournals.org/cgi/content/abstract/vir.0.023168-0v1.

**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.

[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.

**FIGURE 7**
H5N1 HPAI outbreaks in poultry in Indonesia (compared to the rest of the world) between April 2009 and June 2010
*(Source: GoI/ECTAD Indonesia and EMPRES-i)*




During May 2010, PDSR officers visited 2,243 villages, of which 77 (3.4%) were infected. Of these, 49 were new infections, while the rest carried over the infected status from the previous month. This infection rate was lower than the April 2010 infection rate of 4.0%, which was expected as Indonesia is emerging from a usual wet season peak. During June 2010, PDSR officers visited 1,780 villages, of which 45 (2.5%) were infected. Of these, 31 were new infections, while the rest carried over the infected status from the previous month. This infection rate was lower than the May 2010 infection rate of 3.4%. During the previous 12 months, PDSR officers recorded visits in 20,520 villages (28.9%) in the 378 districts under PDSR surveillance. Since May 2008, they have visited approximately 49.4% of villages under coverage. About 8.1% of the villages visited during the previous 12 months were classified as infected. Cases over the last 12 months were concentrated in Sumatera, and 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.

In May 2010, a 34-year old female from DKI Jakarta Province developed symptoms on 25 May 2010, was hospitalized on 27 May 2010 and died on 1 June 2010. The patient was possibly infected from environmental exposure to manure in her plant nursery. In June 2010, a 13-year old female from Sukoharjo District, Central Java Province, developed influenza like illness on 16 Jun 2010, one week after poultry deaths were reported in the neighbourhood, and died on 24 Jun 2010. Of the 167 cases confirmed to date in Indonesia, 138 (83%) have been fatal.

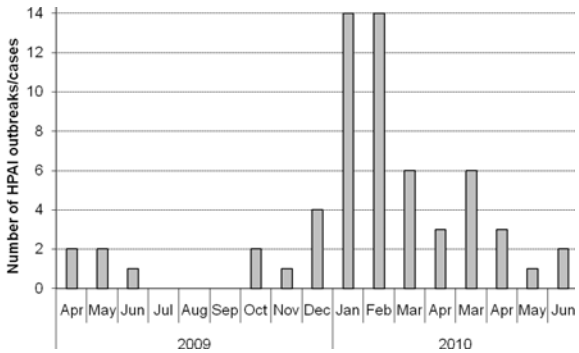
**Lao People's Democratic Republic** experienced its first HPAI outbreak since February 2009 when, on 24 April 2010, clinical HPAI was detected on a layer farm in the capital, Vientiane. Two whole carcasses submitted to the National Animal Health Center (NAHC) laboratory tested slightly positive for Type A Influenza and H5. When some more layers died on 5 May 2010, another two whole carcasses submitted to the laboratory tested positive for Type A influenza and H5 by rapid test. On 6 May 2010, the result was confirmed by RT PCR. In total, 44 layer chickens died. Three samples sent to Australian Animal Health Laboratory (AAHL) in Geelong were identified as Clade 2.3.4, clustering together with viruses seen in Laos previously. Culling of poultry (960 layer chickens, 30 native chickens and 10 Muscovy ducks) and disinfection of the premises were completed on 7 May 2010. Movement controls, active and passive surveillance are on-going within 5 km radius around the infected farm.

In **Mongolia**, on 3 May 2010, 26 whooper swans (Cygnus cygnus) and greylag geese (*Anser anser*) were found dead in Ganga Lake, Sukhbaatar, in the south-eastern border with China. The birds tested positive to H5N1 virus, and subsequent phylogenetic analyses placed them in the 2.3.2 Clade.

**Myanmar** has not detected the H5N1 HPAI since March 2010, in Sagaing Division. Viral analyses of isolates from the first two outbreaks in 2010 showed that these belong to Clade 2.3.4. This is the same clade as the 2007 isolates from the Yangon area, suggesting that this year's outbreaks occurred following a spill over of virus from a reservoir in domestic duck flocks. However, virus from the last outbreak (in March in Sagaing Division), was identified as Clade 2.3.2. This clade had not been found previously in Myanmar.

Myanmar is currently compiling a national database of commercial poultry farms with population and geo-location data to support disease control programmes. Myanmar has almost finished implementing an expanded surveillance programme 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. In addition, longitudinal studies of 100 poultry flocks will be conducted, with sera collected monthly from ducks and backyard chickens in contact with ducks.

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




In **Viet Nam**, H5N1 was first identified in poultry in 2001 and in humans in 2004. In May and June 2010, three H5N1 HPAI outbreaks in Dak Lak, Quang Nam and Thai

Nguyen provinces, affecting ducks (two outbreaks) and chickens and ducks (one outbreak). There is evidence that there is virus circulation without severe clinical signs, particularly in ducks. Increased stress in poultry and increased movement of poultry due to higher demand in the winter months, including the Tet festival period, possibly help in the transmission of the disease, in which these silent carriers possibly play a key role. Consistent outbreak investigations are not undertaken on infected farms and key information is often missing from the field. FAO is assisting the government to improve the outbreak investigation procedures through the development and updating of standard operating procedures (SOPs).

Disease control measures include stamping out on infected farms, movement restrictions for 21 days, compensation 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 second round of 2009, a total of 32 919 samples from 1 138 flocks were collected in 28 provinces for seromonitoring. Results showed that vaccinated poultry have a protection rate[2] of 64% at bird level, which is significantly higher than the flock level protection (46%). Layers [3] had a higher protection rate at bird level (68%) than meat birds (60%). Chickens showed a higher protection level (68%) than ducks (63%). Serology results also show that titers are slightly higher at two months post-vaccination (compared with samples taken earlier or later) and decrease at four months post-vaccination.

Virus circulation surveillance was carried out at the same time as the post-vaccination monitoring in 16 target provinces and cities. A total of 1 912 swabs were taken to monitor virus circulation in slaughterhouses and slaughter points, LBMs or households. Thirty-eight out of 449 unvaccinated flocks tested positive for H5 in 10 provinces. Two of these flocks (in Quang Ninh and Quang Nam provinces) also tested positive for N1.

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. This project has now been completed.
- 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).
- FAO is implementing the USAID (United States Agency for International Development) funded GETS project (Gathering Evidence for a Vaccination Transition Strategy), which started in September 2009. This project is running in five provinces. A major strategy in this project involves the implementation of age-based vaccination in ducks, while reducing the vaccination requirements in chickens and enhancing surveillance, monitoring and vaccination of mobile duck flocks.
- Another USAID project is continuing in five pilot provinces (two in the Red River Delta, one in the Centre and two in the Mekong Delta). It includes a biosecurity component and a surveillance component that focuses on enhancing the reporting system,

[2] HI ≥ 1/16

[3] there is no data available for different poultry species

strengthening the outbreak investigation and response, and developing a community-based surveillance model with local partners. These surveillance activities are increased in high risk locations and periods of the year.

Based on the monitoring of surveillance activities, four currently circulating virus clades have been isolated: (1) Clade 1 (predominant in southern Viet Nam and also isolated in Cambodia); (2) Clade 2.3.4 (predominant in northern Viet Nam and also circulating in China); (3) 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.

No human cases were reported in May or June 2010, but Viet Nam remains one of the countries with more human cases, 119, of which 59 (50%) have been fatal.

## Middle East

In **Israel**, no outbreaks have been reported since two emus in a mini-zoo of a Kibbutz in Hadarom tested positive for H5N1 HPAI in April 2010. Additionally, sequence data became recently available in Genbank for the virus recovered from an outbreak in heavy breeder pullets in Haifa in January 2010. The closest relatives appear to be Clade 2.2 viruses from Egypt.

## Europe

In the **Russian Federation**, 367 wild birds were found dead on 5 June 2010 in Ubsu-Nur Lake, in Tyva Republic, affecting the following species: great crested grebes (*Podiceps cristatus*), goosanders (*Mergus merganser*), grey heron (*Ardea cinerea*), gadwall (*Anas strepera*) and Eurasian spoonbill (*Platalea leucorodia*). Genetic analysis at the All-Russian Research Institute for Animal Health (ARRIAH) in Vladimir, determined that the isolate belongs to Clade 2.3.2 of the Asian linage A/Guandong/1/96 and is 99% similar to the 2009-2010 H5N1 isolates from wild birds in Mongolia, Tyva and Qinghai.

In Europe, after the H5N1 activity reported by the Black Sea coast (two outbreaks in backyard poultry in Romania and one positive case in a common buzzard in Bulgaria), no more H5N1 events were reported during April 2010. Phylogenetic analyses of the HA gene revealed that both the Romanian and the Bulgarian isolates 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 April 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.

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.

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.

**Iraq**, where the last H5N1 HPAI outbreak was in February 2006, has reported recent laboratory results of their surveillance activities for May and June 2010 for all governorates except Kurdistan Province, in the north of the country. In May 2010, all samples taken on poultry farms (53 279), backyard poultry (4 879), game and wild birds (97), and markets and slaughterhouses (110 671) were negative for H5N1. Poultry farms in Babel Governorate tested positive to H9 by PCR. In June 2010, all samples taken on poultry farms (989), backyard poultry (1 307), game and wild birds (70), and markets and slaughterhouses (95 0204) were negative for H5N1. Poultry farms in Babel, Baghdad and Basrah governorates tested positive to H9 by PCR.

## 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 has been gradually decreasing since it peaked in 2006 (Figure 9 – upper right corner). Surprisingly, 2010 has broken the tendency, and the number of affected countries between January and June 2010 already surpasses that of 2009. The total number of outbreaks reported (Figure 10 – upper right corner) shows a similar, but more pronounced, trend, also with a rise during 2010. Between January and June 2010, 390 H5N1 HPAI outbreaks have been reported, compared to 297 in the whole 2009. 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 during the January-March period in terms of countries affected (Figure 9), number of reported outbreaks (Figure 10) and also human cases (Figure 3). In April 2010, numbers started decreasing following high activity season, and such trend has continued during May and June 2010. While February 2010 constituted the peak of the January-March 2010 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).

**FIGURE 9**

Number of countries by continent and by month and year that reported H5N1 HPAI outbreaks since December 2003

*(Source: FAO EMPRES-i)*

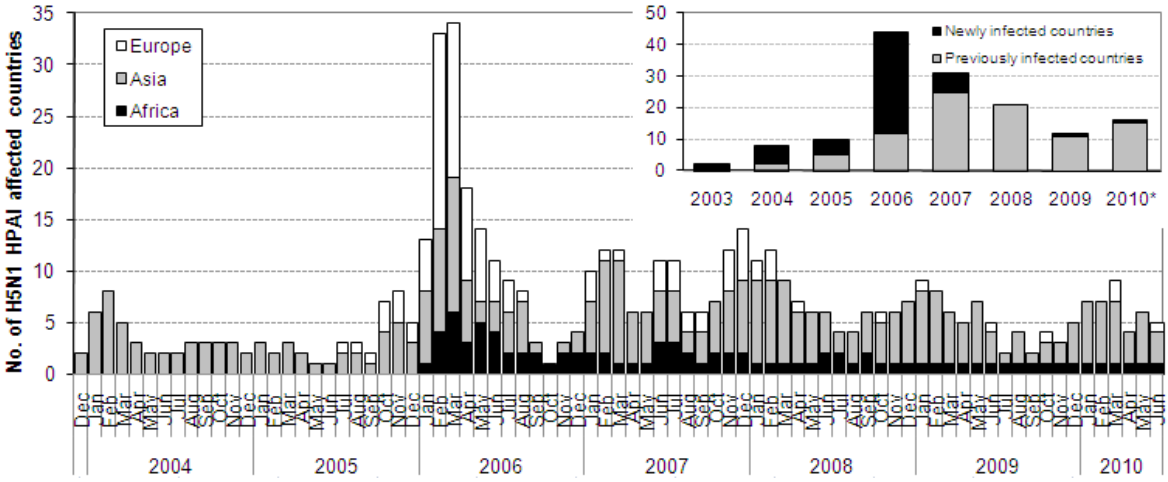
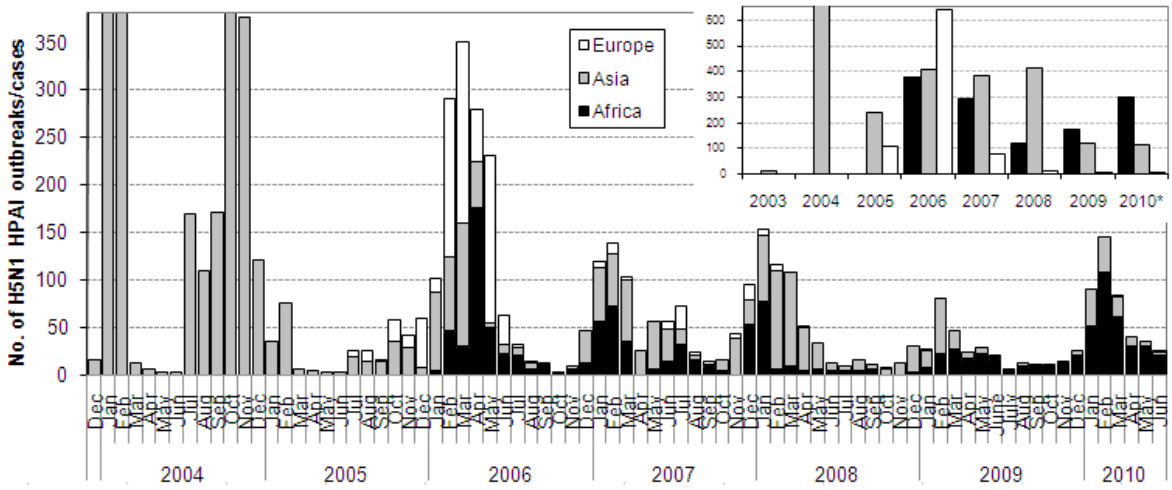



**FIGURE 10**

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 04: 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 of the graph is not distorted)*




During 2010, H5N1 HPAI has re-occurred in several countries where the disease was believed to have been eliminated (without vaccination): Cambodia, Israel, Lao PDR, Myanmar, Nepal, and Romania. 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.

Numerous studies have reported the isolation of avian influenza viruses (AIVs) from surface water at aquatic bird habitats. These isolations indicate aquatic environments have an important role in the transmission of AIV among wild aquatic birds. However, the progressive dilution of infectious feces in water could decrease the likelihood of virus/host interactions. A study by Delogu *et al.* (2010, available at http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0011315) investigated if preen oil gland secretions (by which all aquatic birds make their feathers waterproof) could support a mechanism that concentrates AIVs from water onto birds' bodies. They consistently detected both viral RNA and infectious AIVs on swabs of preened feathers of 345 wild mallards by using RT-PCR and virus-isolation assays.

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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 31 August 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 | **27 August 2010** Menoufia | Domestic poultry – wild birds – donkeys* | **112 / 36** |
| 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 | **19 June 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 | **9 May 2010** wild birds | Domestic poultry – wild birds | **39 / 26** |
| 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 | **June 2010** | Domestic poultry – pigs (with no clinical signs) | **168/ 139** |
| 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 | **18 July 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 | **2 May 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 | **5 June 2010** wild birds | 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 | - |