FAOAIDEnews
Animal Influenza Disease Emergency

Situation Update 67
15 June 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.

Mapping cross-border poultry trade in Lao People's Democratic Republic

Throughout Southeast Asia there are several major consumption centres where rapidly rising incomes and urbanization–combined with population growth–are driving demand for all meats, especially poultry meat. These demands have stimulated the creation and growth of major poultry production clusters. Sustained regional economic progress has also promoted the development and construction of transportation infrastructures, creating new opportunities for trade and movement between and within countries. These active land-based trade routes or movement corridors link production clusters with consumption centres throughout Southeast Asia, and understanding how poultry commodities are produced, moved and consumed is a central element of comprehensive animal health and disease risks management programmes.

Lao People's Democratic Republic (Lao PDR) is a land-linked country that borders with Cambodia, China, Myanmar, Thailand, and Viet Nam. Currently, very little is known about formal and informal trade in poultry and poultry products between Lao PDR and its neighbours. Moreover, owing to limited numbers of commercial poultry farms and rising urban populations, poultry and poultry products transactions from production clusters to consumption centres have increased rapidly in the last 3–5 years in Vientiane Capital, Savannakhet, Champasak, Luang Prabang, Pakxé, Luang Namtha, Vang Vieng, Oudomxay and other local towns. It is believed that the rapid regional spread and geographic distribution of Highly Pathogenic Avian

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Influenza A subtype H5N1 (H5N1 HPAI) and its various clades across these countries might be associated with cross-border poultry trade and movement through motorized vehicles, people and equipments. Lao PDR has experienced a series of H5N1 HPAI outbreaks since 2004. The latest outbreak was reported to international authorities on 14 May 2010. Although the sources of infection for several outbreaks have not been fully elucidated, it is believed that they most likely originated from incoming poultry from neighbouring countries. The Savannakhet province of Lao PDR has seen substantial increase of cross-border trades and movements within the East-West Economic Corridor (EWEC) of the Great Mekong Sub-region. In order to identify, prioritize–according to disease transmission risks–and map the main poultry commodities, inputs and by-products traded and moved within Savannakhet and across the Kaysone district [bordering Thailand] and the Xepon district [bordering Viet Nam], the Food and Agriculture Organization of the United Nations (FAO), in collaboration with the Department of Livestock and Fisheries of the Ministry of Agriculture and Forestry of Lao PDR, held a Workshop on Cross Border Trade for Management of Highly Pathogenic Avian Influenza Risk on 19–20 May 2010 in Savannakhet Province.

The workshop was attended by 33 key stakeholders of the public and private poultry sectors: officials from district and provincial Agriculture and Forestry offices; officials from district trade and market authorities; officials from border check points; as well as various traders and farmers. The outputs of this event are expected to consist of a workshop report, maps detailing cross-border poultry trade, and the value chains of the poultry commodities identified as priorities. All of these efforts are aimed to improve understanding of H5N1 HPAI infection, spread and distribution, as well as to provide timely assistance to Lao PDR in identifying the areas most vulnerable to disease flare-ups in order to implement customized disease control measures and minimize threats to human health. This workshop was supported by the United States Agency for International Development (USAID).

Early and Rapid Diagnosis of Avian Influenza

Influenza A, including avian influenza, is a major public health threat in developed and developing countries. Early, rapid and accurate detection is a key component of strategies to contain, halt or mitigate disease transmission. In the context of highly pathogenic avian influenza (HPAI), the efficient diagnosis of this and other emerging and transboundary diseases is essential to protect animal and human health in the event of a major outbreak.

In a recent scientific consultation on influenza and other emerging infectious diseases at the human-animal interface held in Verona, Italy, it was concluded that there is an urgent need to gain a deeper understanding of host and susceptible population dynamics, along with a firmer grasp of the active and multifaceted interplay between domestic animals and wildlife in diverse agro-ecological systems.

In recent years, experts, scholars and practitioners have highlighted the benefits of using science-based laboratory applications to further elucidate the environmental characteristics used by actual and potential animal hosts in their natural settings. This can be done, for instance, by using stable isotope analysis (SIA), which is a technique that aids in identification of isotopic signatures, the distribution of certain light stable isotopes (for example, Hydrogen-2, Carbon-13, Nitrogen-15, Oxygen-18 and Sulfur-34), and specific chemical elements within complex chemical compounds. This technique, or variations thereof, such as isotope ratio mass spectrometry (IRMS), is utilized to trace food webs and track the origins of target animal species. Some of the substrates for these applications are feather, blood, faecal, hair and aqueous samples collected from animals and the environment.

These techniques are now used - and hopefully can be broadly adopted - to produce the tangible evidence needed to support anecdotal reports that resident animal species are picking up viral diseases from visiting species after they move out (for example, asymptomatic mallard ducks during their sojourn in Siberia shed HPAI in the environment) and also to generate data on the ecology of avian influenzas in key bird species worldwide.

In fact, several research institutes around the world have been trying to gather evidence and generate data through careful and systematic tracking of migratory birds along their flyways by collecting and analyzing samples from wintering and nesting sites to build up reliable isotopic profiles and comparing them to local profiles from where viral disease outbreaks are reported.

In addition to isotope tracing, classical molecular techniques such as Polymerase Chain Reaction (PCR) are being further refined to enhance detection of influenza viruses. In particular, given that HPAI is oftentimes reported in fairly inaccessible rural settings, field PCR tests are now being designed and tested to assess its applicability and usefulness. The advent of new applications and the differing diagnostic capacities of infected locations call for cross-validation of PCR technique between countries experiencing recurrent disease flare-ups.

Given that early and rapid pathogen detection has been posited as a pillar of comprehensive animal disease risk management programmes, the Joint FAO/International Atomic Energy Agency (IAEA) Division of Nuclear Techniques in Food and Agriculture, held the Final Research Coordination Meeting of the Coordinated Research Project (CRP) on "Early and Rapid Diagnosis of Emerging and Transboundary Animal Diseases" on 10-14 May 2010, in Rome, Italy, in which seasoned veterinary laboratory practitioners and diagnostic experts share their knowledge and expertise as the scientific and technical basis for developing or modifying the early and rapid diagnosis of avian influenzas.

The rapid molecular technology platforms developed and fine-tuned by the CRP has allowed improved turnaround time: early, rapid, and confirmed diagnosis has moved from weeks to a day or two, which has in turn improved field cooperation with surveillance programs. This has been critical to rapid and effective avian influenza control in a country with a confirmed incursion of avian influenza H5N1 (e.g. Nigeria).

The infrastructure developed with the avian influenza CRP has allowed future development and growth of other laboratory services (the capability is generic in nature and can be utilized laterally). The avian influenza technology has been shared with public health laboratories where possible, and this has allowed new cooperation and collaboration between the public health and veterinary diagnostic community.

The associated molecular diagnostic training has also allowed improvements to laboratory capability and capacity-building. The sharing of information between the CRP members has assisted in the development of a better understanding of avian influenza diagnosis through molecular techniques including an increased knowledge about the disease's epidemiology, transmission and risks. The project has improved the profile of surveillance programs, including wildlife surveillance, and the capability of the laboratory to carry out the diagnostic components of surveillance efforts.

Additionally, as a complement to ongoing research initiatives and capacity-building efforts, the FAO/IAEA Agriculture and Biotechnology Laboratory, located in Vienna, specializes in research, development and transfer of nuclear methods in animal production and health, among other areas. The laboratory provides a broad range of specialized services and training of scientists, as well as guidance on the introduction of analytical quality control and assurance into counterpart laboratories, and training in the maintenance of laboratory equipment and instruments.

MOST RECENT H5N1 AI OUTBREAKS 2006-2010

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

2010

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

2009

October	Russian Federation
May	China
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 governments

AT A GLANCE

The latest HPAI outbreaks for the period 1 May – 15 June 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 24 H5 HPAI positive cases were reported in 12 governorates during 1 - 31 May: Behera (1), Beni Suef (1), Dakahlia (4), Fayoum (1), Gharbia (2), Helwan(2), Luxor (3), Menoufia (4), Port Said (1), Qalioubiya (1), Sharkiya (1) and Sixth of October (3) (The number of outbreaks in the governorate is in brackets), and there has been no outbreak reported during June. Most of the outbreaks were in household poultry except for one commercial farm in Luxor Governorate. One outbreak in Gharbiya was reported in vaccinated birds.

ASIA

BANGLADESH

A H5N1 HPAI outbreak in Rajshahi Division (Bogra District) was reported on 20 May.

INDONESIA

The Participatory Disease Surveillance & Response (PDSR) programme, through 33 Local Disease Control Centres, covers 70,338 villages in 84% of Indonesia's 448 districts and municipalities in 29 of its 33 provinces. During April 2010, PDSR conducted surveillance in 2,278 villages (3.2%). The overall HPAI incidence was 1.0 newly found infected village per 1000 villages in the coverage area, but incidence varied widely between provinces. The four highest provinces for incidence were Yogyakarta (9.1), Jawa Tengah (3.4), Lampung (2.8) and Kepulauan Bangka Belitung (2.7). The number of newly infected villages found during April by island is: 27 in Sumatra, 44 in Java, and 1 in Kalimantan.

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 Dak Lak Province in May and Quang Nam Province in June were reported on the Government website. The last outbreak occurred on 2 June 2010 in ducks in Duy Thanh Commune Duy Xuyen District of central Quang Nam Province.

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. No birds have been introduced in the mini-zoo since several months.

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.
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WORLDWIDE SITUATION

In April 2010, 129 H5N1 HPAI poultry outbreaks were observed officially in Bangladesh, Cambodia, Egypt, Indonesia and Viet Nam. One case was reported in captive wild birds (emus) in a mini-zoo in Israel. The number of reported outbreaks/cases by country and their location are illustrated in Figures 1 and 2, respectively.

FIGURE 1
H5N1 HPAI outbreaks in poultry in April 2010
(Source: FAO EMPRES-i)

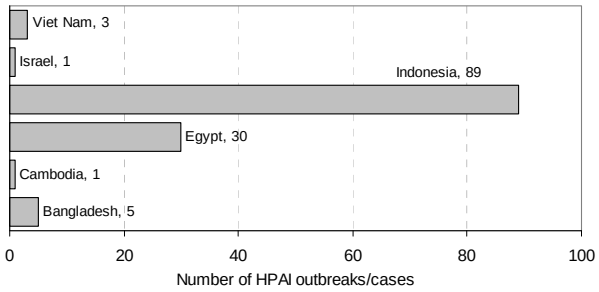
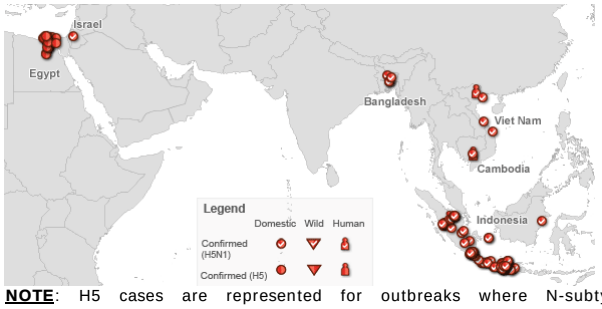


FIGURE 2
H5N1 HPAI outbreaks/cases reported in poultry, wild birds and humans in April 2010
(Source: FAO EMPRES-i)

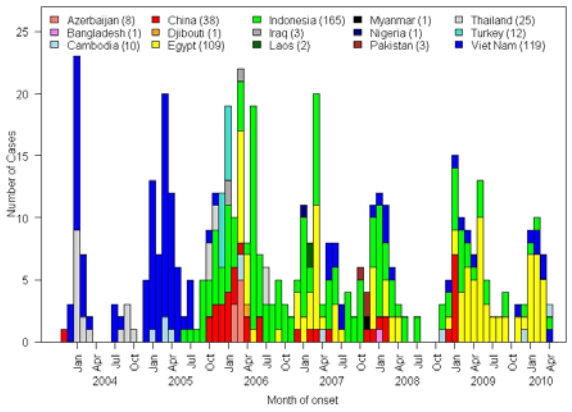


NOTE: H5 cases are represented for outbreaks where N-subtype characterization is not being performed for secondary cases or if laboratory results are still pending. Countries with H5 and H5N1 occurrences only in wild birds are not considered infected countries according to OIE. The original data have 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 April 2010, 498 human cases of H5N1 infection were reported to WHO from 15 countries, of which 294 were fatal, a case fatality rate (CFR) of 59%. Among the countries with more than ten reported cases, Indonesia had the highest CFR of 82% (136 out of 165). 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=475). 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 (245/471). 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 30 April 2010, 26 human cases had occurred: 19 in Egypt (seven fatal), seven in Viet Nam (two fatal), and three in Indonesia (two fatal).

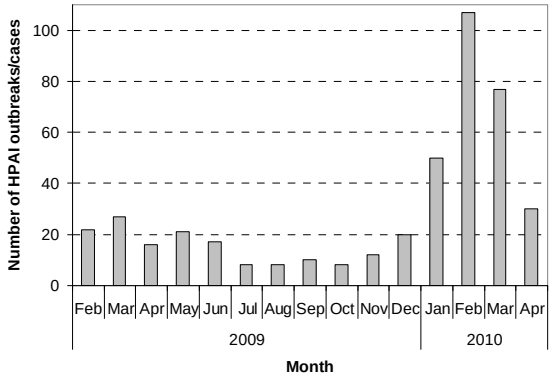
FIGURE 3
Cases of H5N1 AI infections reported in humans by country and month of onset since November 2003
(Source: World Health Organization - WHO)



SITUATION BY CONTINENT/REGION

Africa

FIGURE 4
H5N1 HPAI poultry outbreaks in Egypt between February 2009 and April 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 April 2010, 45 H5 HPAI outbreaks were reported in poultry (chickens and turkeys) from Alexandria (1), Behaira (2), Beni Sweef (2), Dakahlia (1), Domiatt (1), Fayoum (2), Gharbia (1), Kafr el-Sheikh (8), Luxor (1), Minufiyah (8), Minya (2), Port said (1), Qalubia (7), Qena (2), Sixth October (5), and Suez (1) governorates. Of these, 36 outbreaks (80%) were reported from the household poultry sector. Thirty-eight of the 45 outbreaks occurred in non-vaccinated birds while the remaining seven outbreaks occurred in vaccinated birds. During the reporting month, Community Animal Health Outreach (CAHO) teams visited 80 villages in ten governorates and detected seven (15.5%) 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 April 2010, 2,954 samples were collected for this purpose, of which five samples from two governorates were 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 April 2010, 71 poultry farms in 11 governorates were subjected to active surveillance and three were confirmed positive for H5 HPAI infections. Active surveillance was also carried out in 108 household poultry units and 25 samples from 14 governorates were confirmed positive for H5 HPAI.

By way of passive surveillance, one of three HPAI notifications received from commercial poultry farms was found positive for H5 HPAI. In addition, four of the 51 suspected outbreak notifications received from 11 governorates were confirmed positive for H5 HPAI. All 108 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, 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

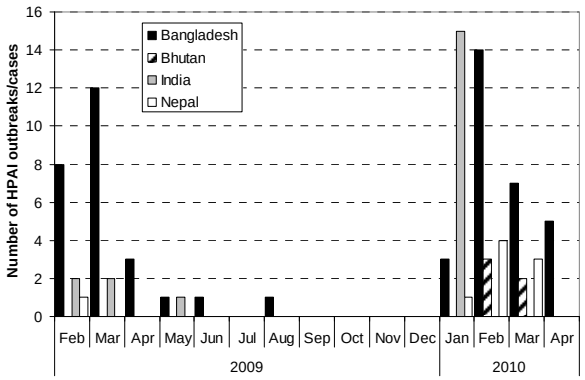
(SAIDR) project, revealed that vaccination coverage was under 20% and flock immunity under 10% in the household sector. The study also highlighted substantial weaknesses in the current immunization programme, mainly due to the difficulties of blanket vaccinations in the semi-commercial and household 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 April 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 result of 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 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.

South Asia

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



In **Bangladesh**, five outbreaks in four chicken layer farms and one backyard flock occurred across the country in Kishoreganj (1), Narayanganj (3) and Mymensingh (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 April 2010, a total of 355 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 April, 22,055 SMS messages were received, including ten suspected HPAI events in backyard poultry and 78 suspected events on commercial poultry farms. The veterinary investigations that followed discounted 45 of these suspect cases and on 43 occasions diagnostic specimens were collected. Of all specimens collected and reported through the SMS gateway system, four tested positive for H5N1 HPAI.

FAO has partnered with Wildlife Trust Bangladesh (WTB), the Bangladesh Bird Club, Wetlands International, Wildlife Trust (USA), United States Geological Survey (USGS) and ICDDRB to undertake a wild bird telemetry project in Bangladesh. This project is 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 radio transmitter on a 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'. Although no wild reservoir for the H5N1 HPAI strain has been identified, scientific evidence suggests that wild birds can be asymptomatic carriers of numerous avian influenza viruses. This project selected specific avian species known to be carries of influenza viruses which also travel the longest migratory routes, for example from the Arctic to Bangladesh via Mongolia and the Himalayas. The sixteen tagged birds in this study were tested for avian influenza exposure or infections through blood and oropharyngeal/faecal samples before they are returned to their natural habitats. The data gathered from the transmitters will be used to assess the flight patterns, including altitude, routes and duration of flights, time spent at each location along the flyways, survival rates and retrospective correlation of stopover sites with reported disease outbreaks. Later this year, it is planned that additional birds will be fitted with transmitters before the migration season starts. 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 (30 April 2010), page 553, available at http://www.sciencemag.org/content/vol328/issue5978/r-samples.dtl. Information on the current location of the birds is available 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 were detected during April 2010. 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.

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 29 March and 24 April 2010, 12 550 active surveillance samples were received at HSADL, Bhopal. Testing was completed on 13 778 samples (some from the previous month), all with negative results, and another 4 687 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.

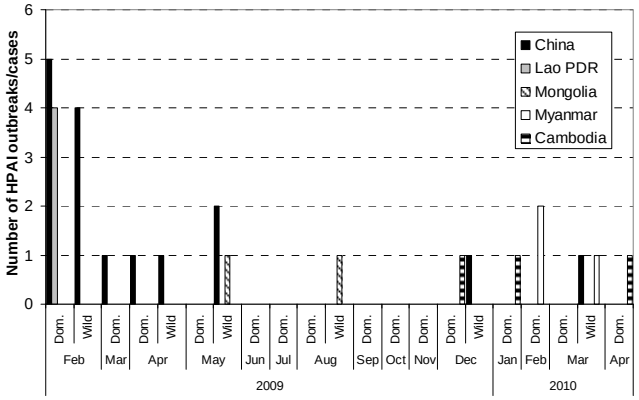
In **Nepal**, no H5N1 HPAI outbreaks were reported in April 2010. The outbreak in Kaski District detected at the end of January spread, despite control measures, to ten secondary outbreaks (referred to as hotspots in Nepal) and a further three in the neighbouring district of Tanahu. During February, 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 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. 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 April 2010

(Source: FAO EMPRES-i)



In **Cambodia**, a 27-year old man from Kampong Leave District, Prey Veng Province became sick on 13 April 2010 and died on 17 April 2010 as a result of respiratory complications after being infected with influenza A/H5N1 virus. The man is the tenth H5N1 infection case and eighth fatality in Cambodia. As with the two previous human cases in Cambodia, humans are acting as sentinels of the disease. Following the H5N1 human case, the area was investigated and three chickens tested positive for H5N1 and were confirmed by the Pasteur Institute on 27 April 2010. Stamping out started on 29 April 2010 (209 chickens and 55 ducks were culled). 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 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 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 national surveillance results released by the Ministry of Agriculture in November 2009 in the Official Veterinary Bulletin (samples collected in October 2009) 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. Since then, the results of December were released but no virus was detected. Results from January to April 2010 have not been released yet.

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, the government 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.

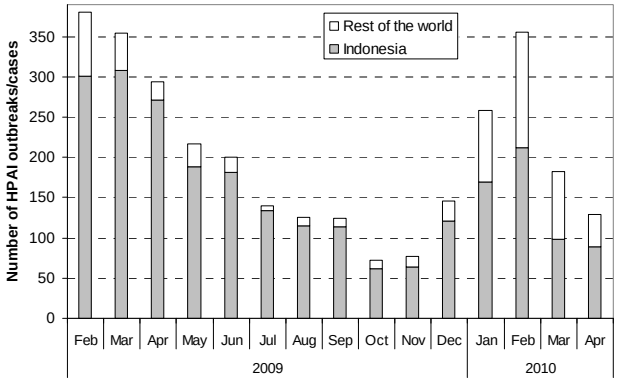
No human cases were reported during January 2010. Since the beginning of the epidemic, China has reported 38 cases, of which 25 were fatal (65.8%). On average, fewer than ten human cases are reported each year (range 0 to 13 cases annually since 2003). The latest case confirmed by WHO was a year ago, 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 infection 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 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.

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 (compared to the rest of the world) between February 2009 and April 2010
(Source: GoI/ECTAD Indonesia and EMPRES-i)



During April 2010, PDSR officers visited 1,919 villages, of which 95 (5.0%) were infected. This infection rate was lower than the March 2010 infection rate of 6.4%, which was expected as Indonesia is emerging from a usual wet season peak. During the previous 12 months, PDSR officers recorded visits in 20,025 villages (29.8%) in the 378 districts under PDSR surveillance. Since May 2008, they have visited approximately 49% of villages under coverage. About 2.9% of the villages visited during the previous 12 months were classified as infected. Cases over the last 12 months were concentrated in Lampung, and Java.

[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.

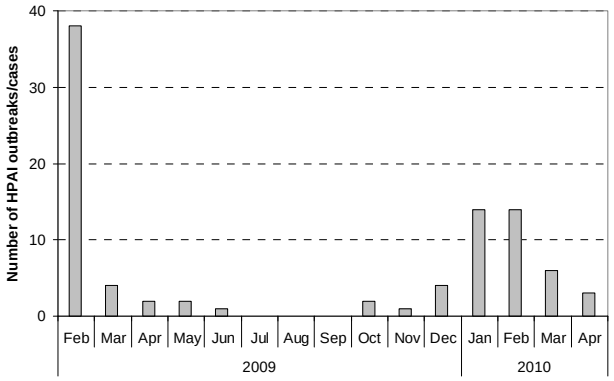
The Indonesian Government introduced vaccination in small flocks in mid-2004. Vaccines containing either an Indonesian H5N1 antigen (e.g. A/chicken/Legok/2003) or H5N2 viral antigen have been used in government programmes, and there are now approximately 20 different licensed vaccines. Vaccination programmes 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 April 2010, a 4-year-old female from Riau Province developed symptoms on 19 April 2010 and died on 28 April 2010. Investigations into the source of infection are ongoing. In addition, a human case observed in February in a 45-year-old female from East Java Province who recovered was reported. She had disposed of dead chickens 4 days before onset of symptoms. Of the 165 cases confirmed to date in Indonesia, 136 have been fatal (CFR=82%).

Myanmar did not detect the disease in April 2010 but had reported outbreaks in February and March 2010. Virus analysis of isolates from the first two outbreaks in 2010 showed that these belong to Clade 2.3.4. This is the same Clade as for isolates from the 2007 outbreaks in the Yangon area, suggesting that this year's outbreaks occurred following a spillover of virus from a reservoir in domestic duck flocks.

A national database for census and geo-location of commercial poultry farms is currently being compiled to support disease control programmes. Myanmar is in the final stages of implementing an expanded surveillance programme 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 April 2010
(Source: FAO EMPRES-i)



In **Viet Nam**, H5N1 was first identified in poultry in 2001 and in humans in 2004. In April 2010, three H5N1 HPAI outbreaks in two commercial farms and one backyard flock were detected in the following provinces: Quang Ninh, Quang Ngai and Quang Tri 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 April 2010, there was one human case in a 2-year old girl that resided in the same village in Bac Kan Province where a 22-year old male had became sick with H5N1 influenza four days earlier, although there is no epidemiological link between these two cases that would indicate human-to-human transmission. The girl developed symptoms on 2 April 2010 and epidemiological investigations show that there were sick/dead poultry at her home and in the surrounding areas. Of the 119 cases confirmed to date in Viet Nam, 59 have been fatal (CFR = 50%).

Middle East

In **Israel**, since the H5N1 HPAI outbreak observed on a commercial poultry farm in Haifa Province in February 2010, two emus with clinical symptoms in a mini-zoo of a Kibbutz in Hadarom tested positive for H5N1 HPAI. The remaining 113 susceptible birds in the zoo were culled. No commercial birds were kept in the 10 km radius. Israel maintains intensive avian influenza surveillance.

Europe

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.

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.

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 April 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, although surprisingly, the total number of outbreaks between January and April 2010 already surpasses the number of outbreaks for the whole of 2009, 356 *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). In April 2010, it becomes evident that we are in the decreasing trend that follows the high activity season. While February 2010 constituted 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

FIGURE 9

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

(Source: FAO EMPRES-i)

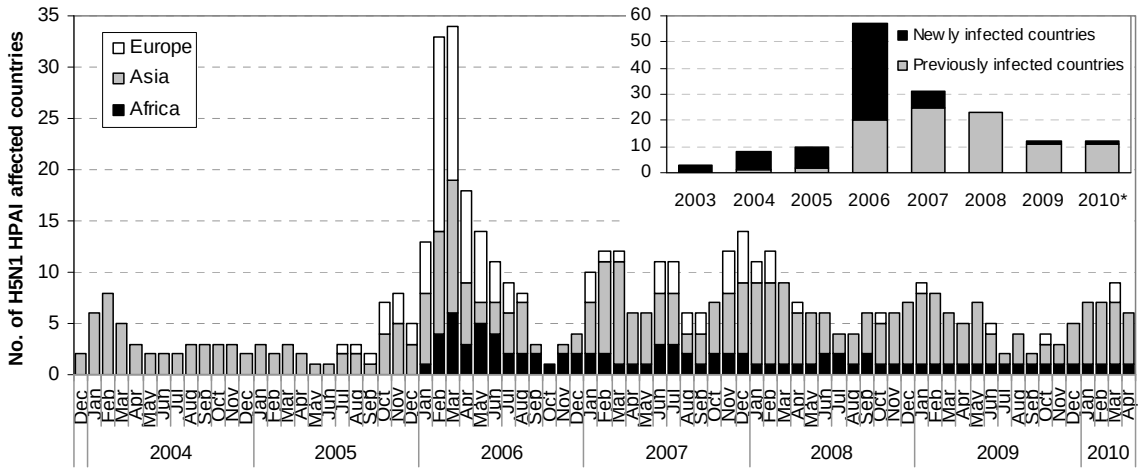
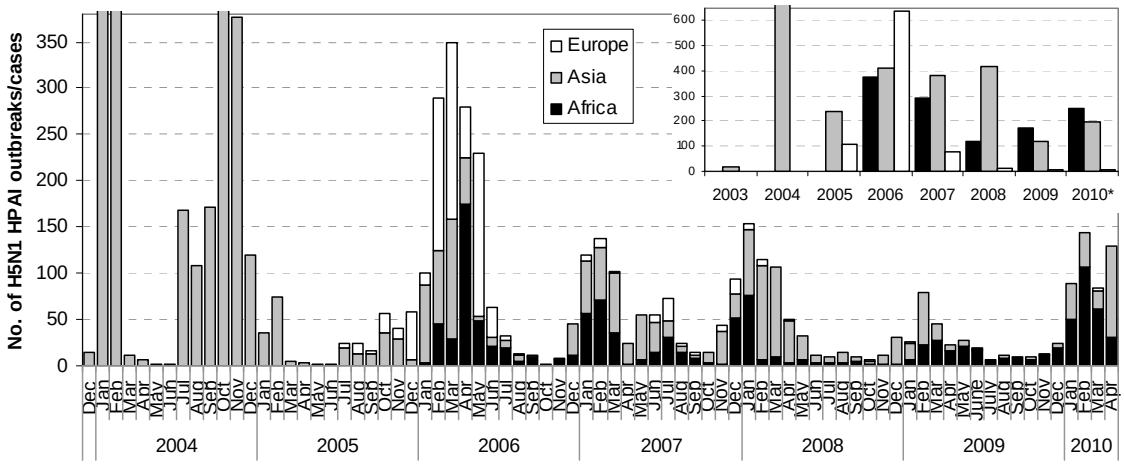


FIGURE 10

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 ar 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)



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-ocurred in several countries where the disease was believed to have been eliminated (without vaccination): Cambodia, Israel, Myanmar, Nepal, Romania and Bulgaria. 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 June 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 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	**20 May 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	**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	**April 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	**2 June 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	-