H5N1 HPAI
Global overview - December 2009

prepared by EMPRES/GLEWS

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## WORLDWIDE SITUATION

One hundred and thirty-one outbreaks of H5N1 HPAI in poultry were reported officially worldwide in December 2009, from Cambodia, Egypt, Indonesia and Viet Nam. There was also a wild bird case reported in Hong Kong SAR, China. The number of reported outbreaks/cases by country and their location are illustrated in Figures 1 and 2, respectively.

**FIGURE 1**
H5N1 HPAI outbreaks/cases reported in poultry and wild birds in December 2009
*(Source: FAO EMPRES-i)*

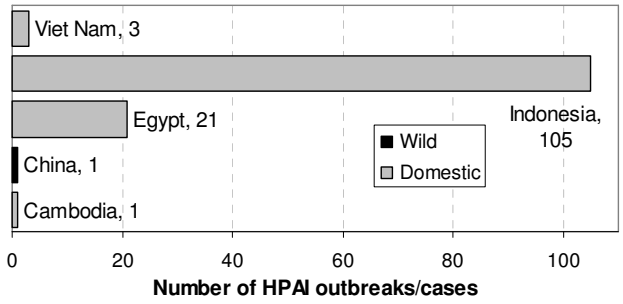
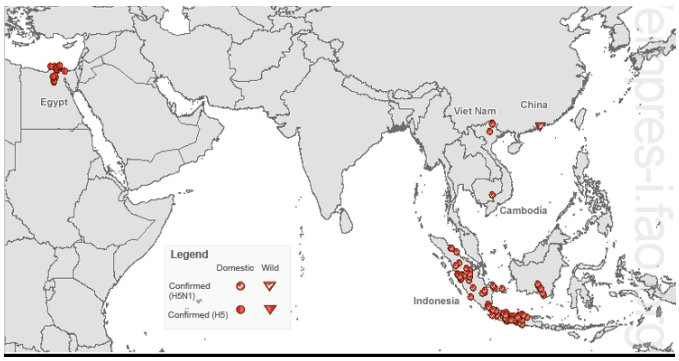



**FIGURE 2**
H5N1 HPAI outbreaks/cases reported in poultry and wild birds in December 2009
*(Source: FAO EMPRES-i)*




**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 status. The original data have been collected and aggregated at the most detailed administrative level and for the units available for each country.

The evolution of the number of outbreaks/cases by species group (wild or domestic) and by geographical area are represented in Figures 3 and 4, respectively.

**FIGURE 3**
Weekly number of reported H5N1 HPAI outbreaks/cases in poultry/wild birds between July 2009 and December 2009
*(Source: FAO EMPRES-i)*

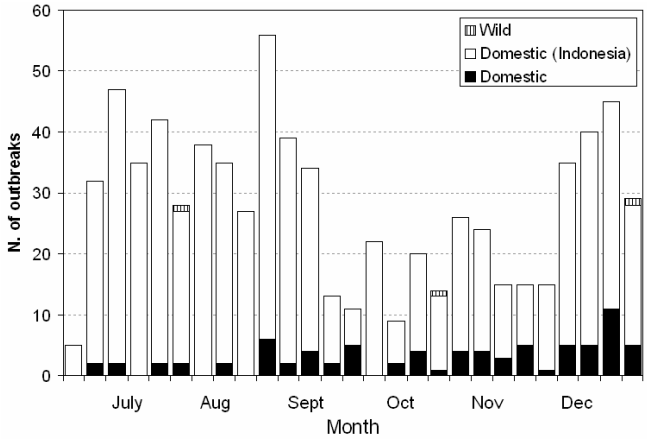



**FIGURE 4**
Weekly number of H5N1 HPAI outbreaks/cases reported by region between July 2009 and December 2009
*(Source: FAO EMPRES-i)*

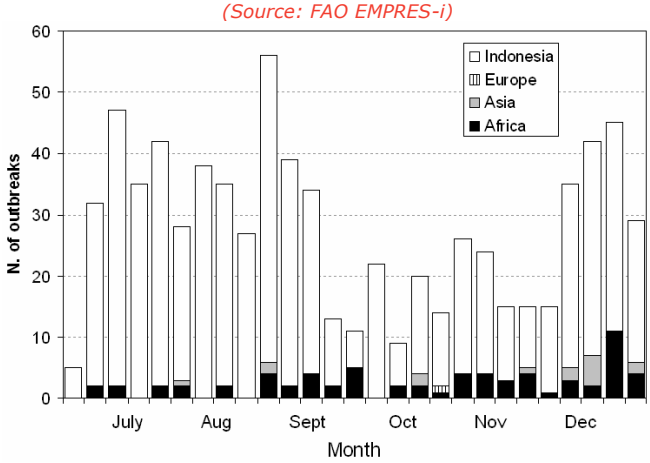
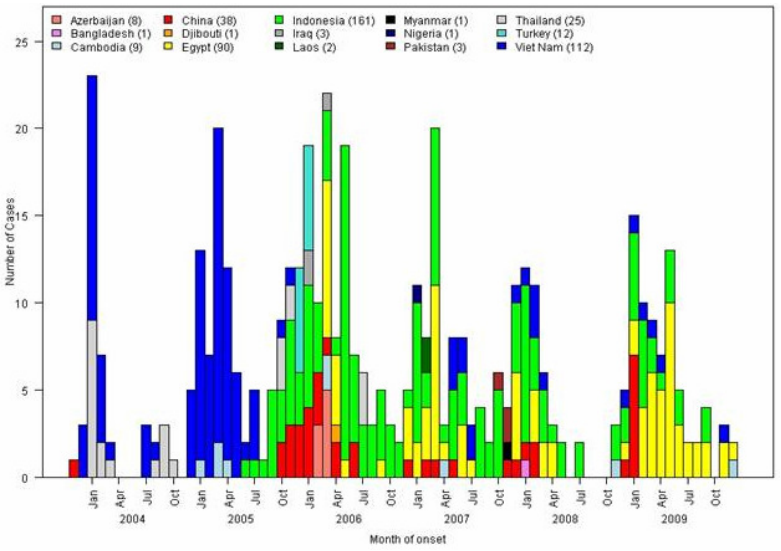



Figure 5 shows the confirmed cases of H5N1 infections in humans reported to the World Health Organization (WHO) by country over time. Between November 2003 and 31 December 2009, 467 human cases of H5N1 infection were reported to WHO from 15 countries, of which 282 died for a case fatality rate (CFR) of 60.4%. Among the countries with more than ten reported cases, Indonesia had the highest CFR of 83.2% (134 out of 161). Age distribution of the reported human cases in all countries ranges from three months to 81 years of age (median 18.0 years of age), with 90.8% (406 out of 447) of patients being under 39 years of age. The highest CFR was among persons between ten and 19 years of age and the lowest was among persons aged above 50. Gender was equally distributed (231 female cases or 51.7%). Indonesia did not report on the age and gender of the 2009 cases.

In 2008, 44 cases were confirmed, with Indonesia reporting the highest number of cases (24 cases or 54.5%), followed by Egypt (8 cases or 18.2%). In 2009, 72 cases (32 fatal - 44%) were reported: 39 from Egypt, 20 from Indonesia, seven from China, five from Viet Nam and one from Cambodia. (Source: Western Pacific Regional Office of WHO, 5 Jan. 2009, Avian Influenza Update Number 216).

**FIGURE 5**
Confirmed cases of H5N1 AI infections reported in humans by country and month of onset since November 2003
*(Source: World Health Organization - WHO)*

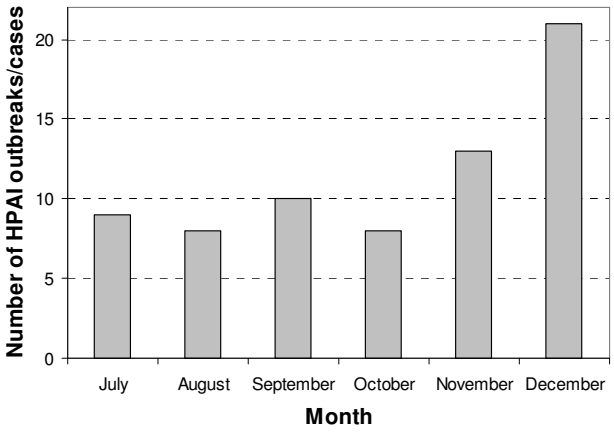


## SITUATION BY CONTINENT/REGION

### Africa

Confirmed outbreaks of H5N1 HPAI in Africa (Egypt) over the last six months are presented in Figure 6.

**FIGURE 6**
Number of reported H5N1 HPAI outbreaks in poultry in Africa (Egypt) between July and December 2009
*(Source: FAO EMPRES-i)*




**Egypt** reported the first H5N1 HPAI outbreak in February 2006, and is now considered as an endemic country where outbreaks are regularly reported from different governorates. In December 2009, Egyptian veterinary authorities reported 21 H5 HPAI outbreaks in poultry (chickens, ducks and turkeys) from Behera (1), Bani-Seuif (1), Dakahlia (4), Fayoum (5), Gharbia (2), Menia (1), Menofia (3), Qalubia (2), Sharkia (1), and Suez (1) governorates. All of these outbreaks (100%) were reported from the household poultry sector. Fourteen of the 21 outbreaks occurred in non-vaccinated birds, while the vaccination status of the remaining outbreaks remains unknown. During December 2009, Community Animal Health Outreach (CAHO) teams visited 84 villages in ten governorates (Sharkia, Gharbia, Dakahlia, Menufia, Fayoum, Behera, Kafr-Elshiekh, Menia, Bani-Seuif and Qalubia) and detected ten (48%) of the above-reported confirmed outbreaks in Dakahlia, Menufia, Mina, Bani-swaif, Sharkia and Fayoum governorates.

The National Laboratory for Quality Control on Poultry Production (NLQP) and GOVS, in collaboration with FAO, conducted surveillance activities targeting both poultry and migratory wild birds around selected important bird areas (IBAs) during winter. In December 2009, 2 000 duplicate samples were collected from domestic ducks around Lake Qaroun in Fayoum Governorate, where four (19%) of the above-reported 21 outbreaks occurred.

Poultry farms are required to test their birds and receive certification (HPAI infection negative status) prior to any planned transportation. During December 2009, 1 926 samples were collected for this purpose and confirmed to be negative for HPAI. In Egypt, compliance with certification for poultry transportation is generally sub-optimal, as only registered farms (< 20 % of the farms) seek such services. During December 2009, no HPAI infections on poultry farms were detected by active surveillance activities (22 farms in three governorates were tested). There were also no notifications of HPAI outbreaks from poultry farms during the reporting period. In the household poultry sector, 15 HPAI outbreaks (out of 263 samples collected from 11 governorates) were detected through active surveillance activities, while 25 samples were collected at road check points and none proved positive for HPAI.

The current government policy is to allow commercial companies to vaccinate their flocks with registered vaccines of their choice. Although there are no official vaccination data, especially from commercial farms, it is assumed that vaccines are widely used in the commercial poultry sectors. All AI vaccines used in Egypt are imported and there are at least 21, all inactivated and mostly the H5N1 Re-1 Chinese vaccine for household poultry and the H5N2 vaccine for commercial farms. The government was providing vaccination of household/village birds free of charge. However, since July 2009, vaccination in backyard/household settings has been provisionally suspended until a new vaccination strategy is adopted. This decision was made after three years of a mass AI vaccination programme, with an apparently limited impact on disease incidence. Despite the continuous vaccination of poultry against HPAI, poultry outbreaks and human cases are reported regularly. A recent assessment study conducted in the framework of the SAIDR (Strengthening Avian Influenza Detection and Response) revealed that vaccination coverage in the household sector is very low (<20%) and that flock immunity level is also less than 10%. The study also highlighted substantial weaknesses in the current immunization programme. The shortcomings of the vaccination strategy may be attributed, in part, to the difficulties of blanket vaccinations in the semi-commercial farm and household poultry sectors, a lack of sufficient funding and communication support, the absence of an efficient monitoring system and inadequate training of field technicians. More information can be found in the paper by Peyre *et al.* (2009) available at http://www.libpubmedia.co.uk/MedJ-Issues/Issue-5/Peyre.pdf.

In December 2009, one human avian influenza A H5N1 case was reported in a 21-year old female from Gharbia Governorate. Investigation revealed that she had close contact with dead poultry and was involved in slaughtering sick birds. Of the 90 laboratory-confirmed cases of influenza A H5N1 reported in Egypt, 27 have been fatal (30%).

In **Nigeria**, there has been no reported case of H5N1 HPAI since July 2008. At the end of 2009 a survey was conducted to understand the production systems, market chains and possible disease transmission risk factors for both domestic and wild birds. Additionally 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.

A phylogenetic analysis by Fusaro *et al.* (2010) of 106 whole-genome sequences from viruses isolated between 2006-2008 identified a major new sub-clade in Nigeria and two novel reassortment events. Two major source populations for the HPAI H5N1 virus in Nigeria were identified: one in the southwest (a major commercial poultry area) and one in the north (where contact between wild birds and backyard poultry is frequent). These findings suggest that migratory birds from Eastern Europe or Russia may serve an important role in the introduction of HPAI H5N1 viruses into Nigeria, although virus spread through the movement of poultry and poultry products cannot be excluded. The paper is available at http://www.ncbi.nlm.nih.gov/pubmed/20071565.

An active and targeted surveillance programme for AI in domestic ducks at markets, on farms and in villages, within a 5 km radius around the outbreaks, will be organized under FAO's supervision in five countries previously infected with HPAI (Burkina Faso, Ghana, Cote d'Ivoire, Benin and Niger).

### South Asia

In **Bangladesh**, although no H5N1 HPAI outbreak was reported during December 2009 for the forth consecutive month, the country is still believed to be endemic with active circulation of the virus. Poultry vaccination against H5N1 AI is prohibited by the government. As of 31 December 2009, a total of 326 outbreaks had been recorded in 47 out of 64 districts on both commercial farms and in backyard holdings and nearly 1.7 million birds had been culled. 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 December over 12 000 SMS messages were received, including 17 suspected AI events in backyard poultry and 30 suspected AI events on commercial poultry farms. The veterinary investigations that followed discounted 41 of these suspect cases and on six occasions diagnostic specimens were collected. All specimens tested negative for Influenza A.

A paper by Biswas *et al.* (2009) recently evaluated the risk factors for HPAI infection in backyard chickens in Bangladesh, through a matched case–control study. The following factors were found to be associated: offering slaughter remnants of purchased chickens to backyard chickens; having a nearby water body; and having contact with pigeons. Separating chickens and ducks at night was found to be protective. The study is at http://www.cdc.gov/eid/content/15/12/1931.htm.

In **India**, no outbreaks have been reported since the last outbreak of H5N1 HPAI was notified on 27 May 2009 in West Bengal. The control measures adopted were stamping out of the entire poultry population, including destruction of eggs, feed, litters and other infected items.

According to the last surveillance report, between 23 November 2009 and 13 December 2009, 5 715 active surveillance samples were received at the High Security Animal Disease Laboratory (HSADL), Bhopal. Testing was completed on 5 587 samples (some from the previous month), all with negative results, and another 4 972 were under test or pending. The periodical reports (available at http://www.dahd.nic.in/birdflue.htm) 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. Another 150 wild bird samples have been submitted from birds trapped at Chilika Lagoon, Orissa and Koothankulam Reserve, Tamil Nadu, as part of an FAO-facilitated satellite tag marking project (http://www.fao.org/avianflu/en/wildlife/sat_telemetry_india.htm). Samples were tested at HSADL and all were negative for the H5N1 virus. During December 2009, the project successfully marked 23 migratory waterfowl with satellite transmitters (seven Ruddy Shelducks, five Eurasian Wigeons, five Gadwalls, three Northern Pintails and three Garganeys). Feathers were also collected for genetic and isotopic analyses from the 23 marked birds. Swab samples (oral and cloacal) and blood samples were collected for avian influenza testing from 93 wild waterbirds and 47 domestic waterfowl. This study will be followed up by additional sampling in January 2010.

A genetic study has been recently published by Chakrabarti *et al.* (2009) analysing the whole genome sequence of three isolates from West Bengal, one isolate from Tripura, and the hemagglutinin (HA) and neuraminidase (NA) genes of 17 other isolates. In the HA gene phylogenetic tree, all the 2008-09 Indian isolates belonged to the EMA3 sublineage of clade 2.2. The 2007-09 isolates from Bangladesh were found to have the closest phylogenetic relationship, rather than the earlier 2006 and 2007 Indian isolates. This implies a third, cross border introduction into India. The study is available at http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0007846.

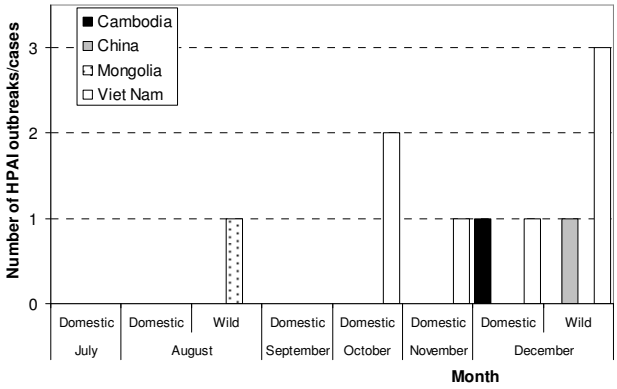
## South East and East Asia

Confirmed outbreaks/cases of H5N1 HPAI in South East Asia over the last six months are presented in Figures 8 and 9.

**FIGURE 7**

Number of H5N1 HPAI outbreaks/cases in poultry and wild birds in South East Asia, by country (excluding Indonesia), between July and December 2009

*(Source: FAO EMPRES-i)*




In **Cambodia**, on 18 December 2009 WHO reported a case of H5N1 infection in a 57-year old male from Ponhea Kreak District, Kampong Cham Province, near the Vietnamese border, who developed symptoms on 11 December 2009. This is the same village where Cambodia's seventh case was confirmed in a 13-year old girl, who died in April 2007. The case was picked up by the Naval Medical Research Unit (NAMRU) as part of an AI cohort study that has been running for the past 18 months, involving 800 adults in different villages in Kampong Cham Province. Of the nine cases confirmed to date in Cambodia, seven have been fatal. This is the first diagnosed case in Cambodia during 2009.

Following reports of poultry die-off in the households around the case and of people eating the dead chickens, an investigation team from the National Veterinary Research Institute (NaVRI) was sent to the village. As a result, an outbreak in backyard poultry was confirmed on 21 December 2009. Six out of six chicken specimens tested positive for H5N1 by RT-PCR (for M gene, H5 gene and N1 gene). The source of the outbreak is under investigation. Culling and disinfection of the village began on 23 December 2009 and lasted for three days. The total number of animals culled was 751 chickens and 124 ducks. The situation resembled that of December 2008, when there was also an isolated human case that triggered the detection of an outbreak in poultry in Kandal Province. No other outbreaks in poultry or human cases were reported in Cambodia in 2008.

Cambodia routinely reports results obtained from surveillance activities through two hotlines supported by FAO at NaVRI. There is also ongoing duck market surveillance at 12 live bird markets in 11 provinces conducted by NaVRI (and supported by FAO) since 2007. None of the samples collected so far have tested positive for H5N1 HPAI.

In 1996, **China** first identified HPAI viruses of the H5N1 subtype in geese in Guangdong Province, and H5N1 HPAI viruses have continued to circulate and evolve since then. Almost 200 H5N1 HPAI outbreaks have been reported in poultry and wild birds in 29 provinces since 2004 and a total of over 35 million poultry have been culled to control the spread of the disease. No poultry outbreaks have been reported since April 2009 and the last wild bird case dates from May 2009. However, official surveillance programmes have demonstrated that H5N1 HPAI viruses continue to circulate in poultry in many provinces. The last figures

released in the Official Veterinary Bulletin by the Ministry of Agriculture covering surveillance activities in September 2009 reported no new viruses isolated from routine surveillance. The last report with isolates dates from July 2009, when the H5N1 HPAI virus was detected in chickens, ducks and geese in Guangdong (including Shenzhen), Fujian (Xiamen) and Chongqing. 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. The carcass of an Oriental Magpie Robin (a common resident bird in Hong Kong) found and collected on 29 December 2009 near the Hok Tau Management Centre in Pat Sin Leng Country Park tested positive for H5N1 AIV.

Mass vaccination against H5N1 HPAI has been implemented since November 2005 (more than 15 billion total production per year, with 5.5 billion permanent poultry population). Combined with other measures, it has succeeded in controlling the disease with an apparent reduction in the numbers of poultry outbreaks since 2004, although as mentioned above, the virus is still circulating in many provinces.

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. Nowadays most birds receive the killed Re-5 regardless of species. The majority of poultry should receive at least two doses of vaccine (primary + booster), except for meat ducks and chickens with a very short production cycle.

This mass vaccination has been possible thanks to: (1) a robust and well designed AI vaccination strategy in place with comprehensive detailed plans at national and local levels; (2) strong, decentralized veterinary services; (3) large-scale involvement of all the stakeholders, including the private sector; and (4) intensive post-vaccination monitoring.

However, some issues remain, such as: (1) some discrepancies in the efficacy of the vaccines from laboratory validation and field application (e.g. lower efficacy in ducks and need for a booster dose in field conditions instead of a single dose protocol); (2) sub-optimal vaccination status and vaccine efficacy in waterfowls; (3) practical limitations regarding backyard vaccination in remote areas; (4) limitations of the surveillance system in terms of assessing the true vaccination coverage and addressing the issue of outbreak detection in vaccinated flocks and/or underreporting of an outbreak; and (5) long-term sustainability of such a mass vaccination strategy.

Virtually all of the identified clades of Asian-lineage H5N1 HPAI virus found so far globally have been detected in China. The main threats from wild birds include Clade 2.2 and Clade 2.3.2. Clade 2.2 viruses have circulated in wild birds predominantly in the north-west of the country since 2005, although such viruses were also found in South Korea and Japan in the winter of 2006-07. Clade 2.3.2 viruses have also been isolated from pikas (*Ochotona curzoniae*), a wild mammal, in Qinghai, China (as well as Clade 2.2 viruses). Clade 2.3.2 viruses have also been detected in South Korea (in poultry), Japan (in wild birds), the Russian Federation (in poultry exposed to viscera from wild birds in April 2008) and in dead wild birds in Tyva Republic, bordering Mongolia (in 2009). An outbreak Clade 2.3.2 was also observed in Mongolia, resulting in the death of many wild birds during the summer of 2009. Sequence information from isolates from Qinghai Lake in 2009 is still awaited. It is highly likely that a cycle of infection with Clade 2.3.2 viruses has become established in wild birds and could pose a threat to poultry in areas where wild birds and poultry are in close association. Viruses in other clades have also been detected in wild birds, including Clade 2.3.4 viruses from Hong Kong SAR.

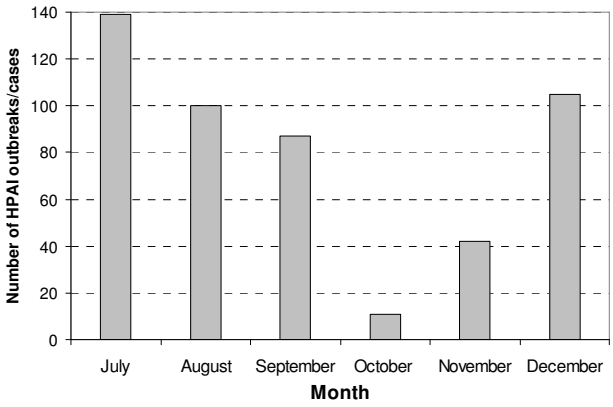
No human cases were reported during December 2009. China reported 38 cases, of which 25 were fatal (65.8%). The latest case confirmed by WHO was on 2 February 2009. On average, fewer than ten human cases are reported each year (range 0 to 13 cases annually since 2003).

**Indonesia** continues to report a high number of H5N1 HPAI outbreaks in poultry (Figure 8), as it has for the past three years. HPAI 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)* 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 8**

Number of reported outbreaks/cases of H5N1 HPAI in poultry in Indonesia, between July and December 2009

*(Source: FAO EMPRES-i)*




During December 2009, PDSR officers visited 1 928 villages, of which 135 (7.0%) were infected (105 were newly found, while the remaining 30 carried over the infection status from the previous month). This infection rate is higher than the November 2009 infection rate of 4.2%. During the previous six months, PDSR officers visited 11 248 villages (16.0%) in the 349 districts under PDSR surveillance. Since May 2008, they have visited approximately 42% of villages under coverage. An average of 6.5% of the villages visited during the previous six months were classified as infected at the time of visit. Infected villages were detected in Kalimantan Selatan and Kalimantan Tengah for the first time during December 2009. Cases over the last six months were concentrated in provinces on Java (especially DI Yogyakarta) and Sumatra (Lampung).

The Indonesian Government introduced vaccination in small flocks in mid-2004. Vaccines containing either an Indonesian H5N1 antigen (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 in the backyard poultry sector were implemented until, as a result of concern over the efficacy of

* 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.

registered vaccines, vaccination by the central government stopped in 2008. 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 practiced.

Indonesia's Ministry of Health, updating information on H5N1 avian influenza for the first time since January 2009, reported that the country had 20 human cases in 2009, 19 of them fatal. However, no information on observation dates, location, gender or age of the victims was provided.

**Lao People's Democratic Republic.** A study by Boltz *et al.* (2009) reported an introduction of H5N1 HPAI clade 2.3.2 in September 2008, a virus found in Korea, Japan and Russia in April 2008. Prior to 2008 all H5N1 isolates in Lao PDR were from clade 2.3.4. The paper also reported the circulation of isolates with decreased sensitivity/resistance to oseltamivir and amantadine. The isolation of two reassortants with PB1 and PB2 genes homologous to Eurasian viruses, leads to a new genotype: P. The study is available at http://www.ncbi.nlm.nih.gov/pubmed/20016036?dopt=Abstract.

In **Viet Nam**, H5N1 was first identified in poultry in 2001 and in humans in 2004. During December 2009, three H5N1 HPAI outbreaks were detected in two small duck-raising households in Dai Tu District, Thai Nguyen Province (09/12/2009); in chickens and ducks in 25 small raising households in three hamlets of Thong Nong District, Cao Bang Province (12/12/09); and in a duck-meat-type small household farm in Dai Tu District, Thai Nguyen Province (12/12/09). From January to December 2009, the Department of Animal Health (DAH) officially reported 53 HPAI outbreaks in 18 (29%) of 63 provinces, mostly on duck farms (approximately 88%) and in the small-scale commercial sector (approximately 73% of outbreaks in flocks with 50 to 1 000 birds). 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 live bird markets of 16 provinces. Results of the post-vaccination monitoring programme for this first round of 2009 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, three 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); and (3) HA clade 7 (detected in poultry seized at the Chinese border and at markets near Hanoi). So far in 2009, ten viruses isolated from outbreaks have been sent to the U.S. Centers for Disease Control and Prevention (CDC) for sequencing, and to date, no new circulating clade has been detected.

A recent study by Carrel *et al*. (2010) showed that there have been at least six independent H5N1 introductions into Viet Nam and there were nine newly emerged reassortants from 2001 to 2007. H5N1 viruses in Viet Nam cluster distinctly around Hanoi and Ho Chi Minh City. More information is available at http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0008631.

A cross-sectional survey conducted in March 2008 in the Mekong River Delta looking at the demographic structure of the itinerant grazing duck population found that larger flocks (>800 ducks) were 7.24 times more likely than smaller flocks to be moved outside their home district, thus potentially spreading the disease. This suggests that surveillance should focus on larger flocks (Minh *et al.,* 2009). The study is at http://www.ncbi.nlm.nih.gov/pubmed/20015558?dopt=Abstract.

In December 2009, there were no human cases. Of the 112 cases confirmed to date in Viet Nam, 57 have been fatal (CFR=51%).

## Europe

The last H5N1 HPAI event in poultry was 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**, **Maldives**, and **Bhutan** have not experienced disease. Some Asian countries regularly report negative results obtained from their surveillance activities and suspected cases. **Bhutan** produces a clinical surveillance report weekly (available at http://www.moa.gov.bt/birdflu/main/reports.php?show=all).

**Iraq**, where the last H5N1 HPAI outbreak was in February 2006, reported recent laboratory results of their surveillance activities for September 2009 for all governorates except Kurdistan Province, in the north of the country. All samples taken were negative for H5N1 [poultry farms (130), backyard poultry (404), game and wild birds (0), and markets and slaughterhouses (53)].

## CONCLUSIONS

Since 2003, 62 countries/territories have experienced outbreaks of H5N1 HPAI. 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, as suggested by the two human cases reported in Egypt in September 2009.

Data from previous years have shown a peak in the number of outbreaks/cases during the January-March period in both poultry outbreaks (Figure 9) and human cases (Figure 5), although there is a decreasing trend in the height of the peak as years go by. According to the general trend, we can expect an increase in the total number of outbreaks and countries affected in the coming months. In fact a gradual increase can be observed in the total number of reported outbreaks since October 2009. A secondary peak was shown in 2007 and 2008 during the June-August period, which has not been observed this year. Although Bangladesh is considered endemic, the country has not reported any H5N1 HPAI activity for four months. In order to confirm that the zero outbreak reports are valid, major efforts may be needed to strengthen the sensitivity of surveillance systems. In any case, we will need to wait longer to see if this trend of no reports and no detection of virus activity continues, before we can consider Bangladesh to be no longer endemic.

In the case of Egypt, the situation in terms of human infections has worsened since last year, although the situation seems similar in terms of poultry outbreaks (176 in 2009 compared to 116 in 2008). As of December 2009, there had been 39 human cases, mainly in children under four years of age, which is a five-fold increase when compared to the eight human cases reported during the same period in 2008. However, the case fatality rate has decreased from 50% in 2008 to 10.3% in 2009, thanks to the efforts of the Ministry of Health.

Globally, December 2009 showed almost identical activity when compared with December 2006 and 2008 in terms of number of countries affected (Figure 10) and number of outbreaks reported (Figure 11). December 2007, however, showed much higher numbers (88 outbreaks in 14 countries), reflecting the time when the pandemic was extending across Central Asia and into Europe and Africa. 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 many countries and regions because of limitations in the capacity of veterinary services to implement sensitive and effective disease surveillance and outbreak investigations for H5N1 HPAI, and because of the weakness of compensation schemes.

**FIGURE 10**

Number of countries by continent that reported H5N1 HPAI in December 2006, 2007, 2008 and 2009

*(Source: FAO EMPRES-i)*

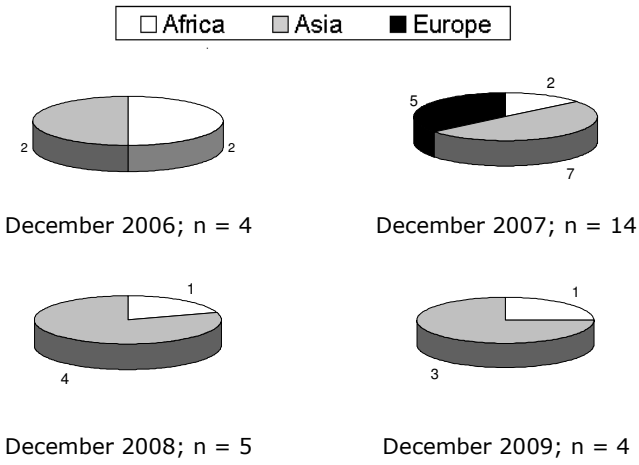



**FIGURE 9**

Number of reported 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), have been truncated so that rest of the graph is not distorted)*

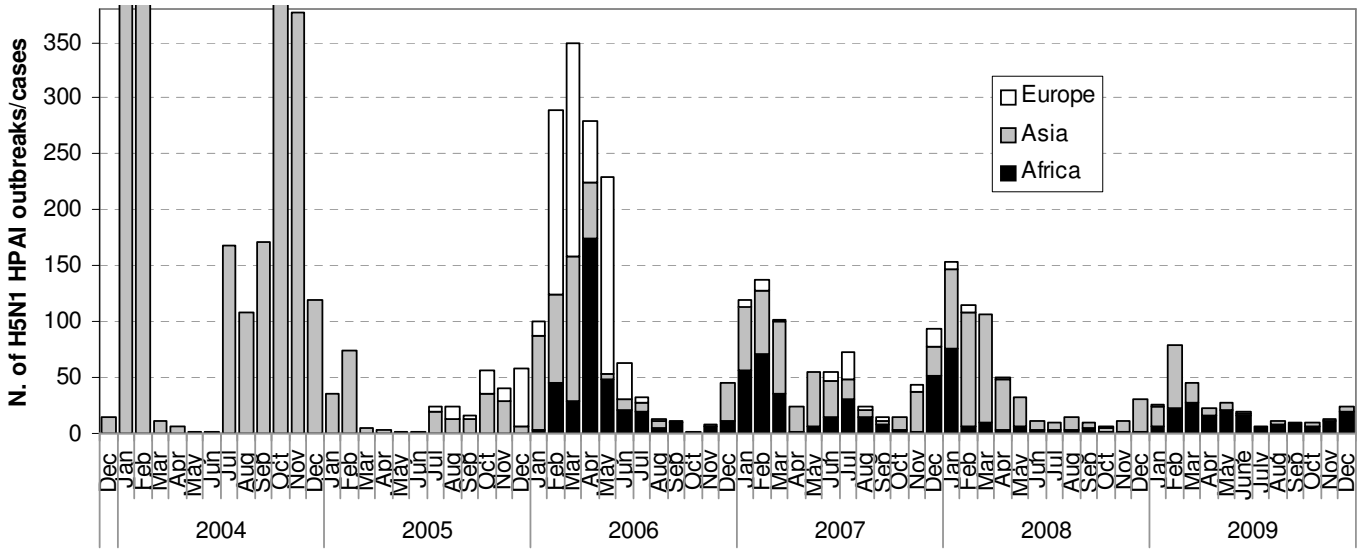
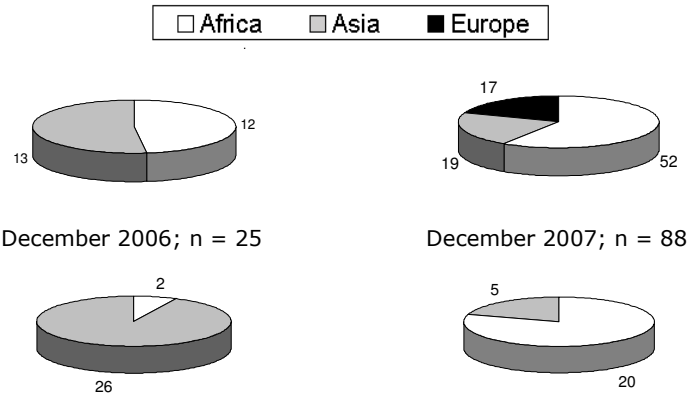


**FIGURE 11**
Number and distribution of H5N1 HPAI outbreaks/cases by continent in December 2006, 2007, 2008 and 2009
*(Source: FAO EMPRES-i; Indonesia data are not included, because the epidemiological unit definition for the PDSR data was modified from household level to village level in May 2008 and is not comparable)*




December 2006; n = 25 | December 2007; n = 88

December 2008; n = 28 | December 2009; n = 25

An animated map showing the evolution of outbreaks over the last six months including December 2009 is available at: www.fao.org/ag/againfo/programmes/en/empres/maps.html.

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This overview is produced by the GLEWS team of FAO in EMPRES, 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 and Response System for Major Animal Diseases including Zoonoses.
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. Information will be treated confidentially if requested.