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Opinion

of the French Food Safety Agency on measures to be implemented on poultry farms regarding the human epidemic of the 2009 A (H1N1) influenza virus

DIRECTOR-GENERAL

Review of the request

On 15 September 2009 the Directorate General for Food (DGAL) submitted a request to the French Food Safety Agency (AFSSA) to evaluate the relevance of various measures that could be implemented on poultry farms to control the human epidemic of the 2009 A (H1N1) influenza virus.

Report of the 'Avian Influenza and 'Swine Influenza' emergency collective assessment groups

The available members of the 'Avian Influenza emergency collective expert assessment group ('IA' GECU), appointed on 22 August 2005, then changed on 3 and 7 March 2006 and on 16 November 2007 and of the 'Swine Influenza' emergency collective expert assessment group ('IP' GECU), appointed on 22 May 2009, met at AFSSA and communicated by e-mail and telephone on 8 and 16 October 2009 to draw up this report and its conclusions:

"Context

- *On 21 August 2009, the Chilean health authorities officially notified the World Organisation for Animal Health (OIE) that two turkey breeder farms belonging to the same company had been contaminated by the 2009 A (H1N1) influenza virus. The farms are at Las Palmas and Pucalan in the Valparaiso region, about 19 miles (30 km) apart. In the first outbreak at Las Palmas on 23 July 2009, about 24,000 out of 30,000 animals showed a syndrome of reduced laying-rates and inferior quality of eggshells. Apart from that no respiratory symptoms or abnormal mortality rates were reported. The only lesions observed were salpingitis, peritonitis and interruption of follicular development. On the second farm, the same clinical symptoms were observed on 29 July 2009 in about 12,000 out of 30,000 breeder turkeys. Both outbreak areas were put under surveillance.*

The report of the Chilean authorities to the OIE indicated that in the Las Palmas outbreak the first cases of the disease occurred in a breeder barn before spreading to three other buildings.

The epidemiological investigation (OIE report of 26 October 2009) attributed the cause to human contamination via the insemination teams. It found that respiratory symptoms had been observed in people in contact with the poultry before the first clinical symptoms were observed in the latter.

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Two reports on the epidemiological situation written by the Chilean Health Authorities and sent on 31 August and 3 September 2009 respectively to the OIE and the Directorate General for Health and Consumer Affairs (DG Sanco) indicated that serological samples had been taken on the company's other turkey farms and that all had tested negative for the 2009 A (H1N1) influenza virus. Samples taken from wild birds found near the outbreaks and samples taken during surveillance monitoring of Avian influenza virus on Chilean farms had also tested negative.

Analyses of the samples taken from turkeys on the two farms, conducted by the Chilean Public Health Institute on the one hand and by the USDA laboratory at Ames on the other, showed great homology of genome sequences between the virus isolated from turkeys on these farms and the 2009 A (H1N1) influenza virus, responsible at the same time for the human influenza epidemic in the Chilean population.

The OIE report of 26 October 2009 announced that egg-laying rates only returned to normal 7 weeks after the onset of the symptoms, while the virus could no longer be detected 3 to 4 weeks after the symptoms began.

- Moreover the Canadian authorities in the province of Ontario announced on 20 October 2009¹ (confirmed by an OIE report on 23 October) that an outbreak of 2009 A (H1N1) influenza virus had been observed on a turkey breeder farm using grandparent stock with a high level of biosecurity, which was most likely due to contamination by humans, given the great homology of the virus detected with those found in samples of human origin. The infected animals showed, as for the Chilean case, a drop in laying-rates, with no increase in mortalities specifically due to the viral infection. The farmer decided to put his farm in quarantine. There were no plans for slaughtering the turkeys.

Questions raised

Following the discovery of the 2009 A (H1N1) influenza virus circulating on two Chilean farms, the DGAL has requested AFSSA's opinion as to whether it would be advisable to introduce preventive, surveillance and control measures for French poultry farms, particularly concerning:

- the risks of the 2009 A (H1N1) influenza virus circulating between people and poultry:
 - "What risk would be involved and through which routes would poultry be contaminated by the 2009 A (H1N1) influenza virus through contact with farmers or infected people?
 - What risk would be involved and through which routes would humans be contaminated by the 2009 A (H1N1) influenza virus through contact with poultry, if flocks were contaminated?
 - What role would poultry play in maintaining (or aggravating) the circulation of the 2009 A (H1N1) influenza virus in animal populations? What would be the risk of this new virus circulating within poultry populations and in particular, with the emergence of new strains?
 - Do these different risks vary according to the species in question?"
- protection of poultry farms against contamination by the 2009 A (H1N1) influenza virus:
 - "Is the objective of preventing poultry farms from being contaminated justified given the public health risk? Should this objective include all poultry farms or just those with certain species?"

¹ <http://www.radio-canada.ca/regions/Ontario/2009/10/20/004-h1n1-dindes.shtml?ref=rss>; Ontario Ministry of Agriculture, Food and Rural Affairs; Canadian Press

- some biosecurity measures have already been defined by Ministerial order to counter the risk of the avian influenza virus being transmitted to poultry farms:
 - In the light of the answers to the previous questions, is it relevant to recommend that farmers and professionals in poultry sectors with clinical symptoms corresponding to the definition of possible cases of infection by the 2009 A (H1N1) influenza virus according to the French Institute for Public Health Surveillance (InVS) avoid all contact with poultry (or only with some species of poultry)? In this context, might the wearing of a surgical mask be an effective way of preventing animals from being contaminated by people?
 - Are there any other specific biosecurity measures which could be recommended to poultry farmers in general and particularly when the farmers themselves have clinical symptoms indicating a possible case of infection by the 2009 A (H1N1) influenza virus?
 - Should the vaccination of people in contact with poultry (farmers, veterinarians, farm workers) against the new virus be a priority objective once the vaccine is available in France?"
- *surveillance measures:*
 - "Given the Chilean case, is the particular surveillance of poultry farms (or certain poultry species) justified?
 - Should the surveillance measures take into account the epidemiological factor (i.e. the existence of a human case of infection by the 2009 A (H1N1) influenza virus) in relation to poultry farming, as has been suggested for the surveillance of pig farms?"
- *control measures in the case of the 2009 A (H1N1) influenza virus being identified in poultry:*
 - "Which measures should be recommended if the 2009 A (H1N1) influenza virus is detected on a poultry farm? Should these measures depend on the species in question?
 - Which preventive measures should be recommended to those people who are the most exposed by their work (farmers, veterinarians, technicians, farm workers) and who have been or are in contact with animals likely to be infected by the 2009 A (H1N1) influenza virus in the case of an outbreak on a farm?

Assessment method

Following the meeting at AFSSA and by telephone on 8 and 16 October 2009, the scientific coordination committee of the 'Animal Health' Scientific Panel wrote a report that was jointly drafted by the members of the 'IP' Gecu communicating by e-mail and validated on 26 October 2009.

The assessment was carried out on the basis of:

- *documents provided by the requesting body:*
 - *the letter of request dated 15 September 2009;*
 - *the fax from the European Commission concerning the discovery of a case of infection by the 2009 A (H1N1) influenza virus in turkeys in Chile;*
- *AFSSA Opinion no. 2009-SA-0230 concerning the public health risk associated with the 2009 A (H1N1) influenza virus, on surveillance and control measures to be implemented in pig populations as laid down in the European Commission guidelines concerning this virus and specific biosecurity measures to be implemented for pig farms, dated 30 September 2009;*

- AFSSA Opinion no. 2009-SA-0229 on surveillance measures to be implemented in France on pig farms concerning this virus and control measures to be considered in the case of outbreaks of the 2009 A (H1N1) influenza virus occurring on pig farms;
- the official notifications of the Chilean authorities to the OIE in the case of the 2009 A (H1N1) influenza virus found in poultry on two farms. These notifications may be found at the following sites:
http://www.oie.int/wahis/public.php?page=single_report&pop=1&reportid=8389;
http://www.oie.int/wahis/public.php?page=single_report&pop=1&reportid=8404;
- the Chilean epidemiological surveillance report dated 1 September 2009 which was sent to the Directorate General for Health and Consumer Affairs (DG-SANCO) on 3 September 2009;
- various scientific articles listed in the 'Main Bibliography' annexe;
- exchanges between the experts of the 'Avian Influenza' and 'Swine Influenza' emergency assessment collective groups.

Discussion and recommendations

In their preamble, the 'Avian Influenza' and 'Swine Influenza' emergency assessment collective groups reviewed the latest scientific information available on infection of poultry by the 2009 A (H1N1) influenza virus.

- A recent experimental study (Swayne, 2009), not yet published, investigating infectiosity, the transmission of the 2009 A (H1N1) influenza virus to poultry and the pathogenic virulence of the infection in different species, has shown, following intra-nasal insertion of a Mexican strain of the 2009 A (H1N1) influenza virus into chickens, ducks, adult turkeys, poults and quails at doses much higher than those involved in a natural infection;
 - the lack of symptoms in chickens, ducks, turkeys and poults infected by this route;
 - no viral RNA and/or seroconversion detected in this poultry;
 - on the other hand, seroconversion and microscopic rhinitis lesions, associated with positive detection in the immunohistochemistry and the presence of viral RNA in oropharyngeal swabs from infected quail;
 - the lack of secondary transmission in contact quail.
- An English study (Russell et al., in press) reported similar results during experimental infection by ocular-nasal insertion of a Californian strain of the 2009 A (H1N1) influenza virus into turkeys, using several doses lower or equal to those used in Swayne's study (2009) and placing poults in contact. The only difference observed was the transient detection of very low amounts of viral RNA in only two of the experimentally infected subjects out of the ten which had received the strongest dose, while all the other poults infected with smaller doses or placed in contact tested negative.
- An Italian team (Terregino et al., 2009) has just published results that are consistent with those obtained in previous studies. In the Terregino et al. study, turkeys and poults were oro-nasally infected with a very high dose (10 times greater than the highest dose used in the two tests previously referred to) of an Italian strain of the 2009 A (H1N1) influenza virus and then turkeys and poults were placed in contact with the inoculated birds. The Italian strain had the particularity of having a mutation (that arose during ovoculture) at the cellular receptor-binding site that confers an affinity for alpha-2,3 sialic acid receptors (whereas the 2009 A (H1N1) influenza virus normally shows an affinity for alpha-2,6 sialic acid receptors). 'Mild, non-specific symptoms' were observed in poults and some showed seroconversion, probably related to the high administered dose.
No virus or viral RNA were found in either the cloacal or tracheal swabs, the

respiratory and digestive organs, the blood or the muscles, irrespective of the group to which the birds belonged. No viruses were transmitted from inoculated animals to contact animals.

- An unpublished Canadian study is reputed to have demonstrated the seroconversion of turkeys inoculated by the intracloacal route (J. Pasick, oral communication, September 2009).
- Finally Lange et al. (2009) showed that chickens placed in contact with pigs which had been experimentally infected with the 2009 A (H1N1) influenza virus did not develop clinical symptoms, did not shed the 2009 A (H1N1) influenza virus and did not develop antibodies to counter the virus, unlike the contact pigs which had also been used in the study. The authors concluded that, unlike the transmission of the 2009 A (H1N1) influenza virus between pigs, this did not occur between pigs and chickens. Lange et al. (2009) also tried to infect chickens directly with the 2009 A (H1N1) influenza virus, but did not succeed.

The 'Avian Influenza' and 'Swine Influenza' emergency assessment collective groups emphasized the lack of consistency, in clinical and virological terms between field observations made in Chile and Canada, where the infection appears to be of human origin and observations made following experimental infections of turkeys. Moreover, according to the report of the Chilean authorities, the virus, particularly for the first outbreak at Las Palmas, was rapidly and easily propagated by horizontal transmission between turkeys in growing and reproduction buildings, which is not very consistent with experimental observations which have demonstrated a lack of contact transmission.

These observations allow for several hypotheses for the Las Palmas outbreak and in particular that:

- i) the infection of turkeys in the other buildings might be due to human contamination with people being the biological vectors; this hypothesis appears to have been confirmed, since the inseminators may have caused the contamination, according to the OIE report of 26 October;
- ii) the virus had mutated and adapted to turkeys;
- iii) other related aggravating factors may explain the clinical symptoms observed on this farm.

The different levels of risk described in this opinion below, should thus be reconsidered in the light of any new epidemiological and scientific data concerning the infection of poultry with the 2009 A (H1N1) influenza virus.

1° Risks of the 2009 A (H1N1) influenza virus circulating between humans and poultry

- a) "What would be the risk of poultry being contaminated by the 2009 A (H1N1) influenza virus and through which routes, through contact with farmers or infected people?"
- The shedding of the 2009 A (H1N1) influenza virus by infected people occurs mainly via the airborne route, since contamination of poultry by the virus shed by infected farmers and farm workers is most likely transmitted by the respiratory route, via nasal discharge and aerosols. However, given the experimental data which suggest possible infection of turkeys by the 2009 A (H1N1) influenza virus via the cloacal route (Pasick, 2009) on the one hand and by the Chilean observations, on the other hand, which strongly suggest that the inseminators were the vector, the possible infection of turkeys by cloacal and/or vaginal routes should be carefully investigated.

- *We may assume that as the number of human infections by the 2009 A (H1N1) influenza virus increases, the exposure of poultry via infected workers will increase as well. However the 'Avian Influenza' and 'Swine Influenza' emergency assessment collective groups have emphasized the limited surveillance of flu symptoms in the human population. Indeed, it is true that symptoms indicating an infection in people are not systematically confirmed and that it is difficult to assess the actual infection of poultry farms by farm workers in contact with the animals.*
- *No infections of poultry by the 2009 A (H1N1) influenza virus have been reported in France up to now. We cannot exclude the possibility that other avian cases which may be attributed to the 2009 A (H1N1) influenza virus have gone undetected elsewhere than in Chile and Canada, including in France. However, if there had been an intensification of such clinical phenomena in countries such as France, whose territory is well covered by specialized aviculture veterinarians, it is very likely that such case of poultry infection would have been detected.*
- *Given the low receptivity of the poultry species referred to above to infection by the 2009 A (H1N1) influenza virus, as reported in the experimental studies and due to the lack of infection of avian species by this virus reported in Europe as of 26 October 2009, the 'Avian Influenza' and 'Swine Influenza' emergency assessment collective groups believe that the risk of the poultry species referred to above being contaminated by the 2009 A (H1N1) influenza virus conveyed by farmers or infected people in Metropolitan France may be considered to be 'close to zero' (level 1 on a scale from 0 to 9).*

b) "What would be the risk of humans being contaminated by the 2009 A (H1N1) influenza virus through contact with poultry and through which routes, if farms were contaminated?"

- *It is generally acknowledged that the influenza viruses multiply in avian species in the digestive and respiratory systems (for mildly pathogenic viruses) and in more organs, or even all of them (for highly pathogenic viruses – HP) depending on the species concerned and the age of the infected birds (AFSSA, 2008).
The data from experimental infections of poultry by the 2009 A (H1N1) influenza virus show that there is no viral replication and shedding in experimentally inoculated species except for quail which can multiply the viruses in the respiratory system but not sufficiently to enable secondary transmission to contact quail.*

Humans are only rarely contaminated with avian influenza viruses and then mainly with HP viruses. When contamination occurs, it usually arrives by the respiratory route, via discharges and the aerosols emitted by the infected animals or generated during bleeding, plucking and evisceration operations or handling, via droppings, infected carcasses or any contaminated equipment coming into contact with the oronasal mucous membranes. Concerning the 2009 A (H1N1) influenza virus, based on the results of experimental studies, it seems likely that humans are contaminated with this virus from poultry via the respiratory route. We should remain circumspect as to the possibility of viral replication in the oviduct of adult turkeys, because it has already been shown that influenza viruses of avian origin replicated to high titers there (Pillai et al., 2009). This might mean that humans, and particularly inseminators, are more heavily exposed through hand transmission, and not merely by the airborne route. The likelihood of this occurring is minimised however by the very low number of $\alpha 2,6$ receptors, to which 2009 A (H1N1) influenza viruses are capable of attaching themselves, in the genital tract of turkeys (Pillai et al., 2009). (See 2/c).

- *The 'Avian Influenza' and 'Swine Influenza' emergency assessment collective groups consider that the risk of human contamination with the 2009 A (H1N1) influenza virus*

from infected poultry belonging to species already mentioned may be considered as less than the estimated risk from infected pigs and therefore situated between zero and close to zero (between level 0 and level 1 on a scale of 0 to 9).

- c) "What role would poultry play in maintaining (or spreading) the circulation of the 2009 A (H1N1) influenza virus in animal populations? What would be the risk of this new virus circulating within poultry populations and in particular, with the emergence of new strains?"
- *Circulation of influenza viruses in poultry is related to the capacity for replication of these viruses in the different avian species. Replication is a function of the following factors: the affinity of the viral hemagglutinin for the cell receptor (in this case sialic acids or SAs, which are attached to the galactose by an $\alpha 2,3$ or an $\alpha 2,6$ linkage), the activity of the replication complex depending on the cellular environment, and the liberation outside the cell of newly-formed virions, whose effectiveness depends on the compatibility of the viral neuraminidase with the cell receptors (Matrosovich et al., 2006; Subbarao et al., 1993).*
 - *Although ducks have epithelial cells in their digestive tract that have receptors with SAs attached to the galactose with only an $\alpha 2,3$ linkage, quails and chickens have epithelial cells in their digestive tract with receptors whose SAs are attached with both $\alpha 2,3$ and $\alpha 2,6$ linkages, the second of which allows human or swine viruses to attach themselves (Baum et Paulson, 1990; Guo et al., 2007; Ito et al., 2000; Suzuki et al., 2000). Furthermore, turkeys have large numbers of $\alpha 2,6$ receptors in their tracheas (Yassine et al., 2007). Pigeons also have the same $\alpha 2,6$ receptors in considerable quantities in the cells of their respiratory tract (Liu et al., 2009).*
 - *Turkeys are capable of multiplying swine viruses of sub-types H1N1, H1N2 and H3N2 (Andral et al., 1984; Hinshaw et al., 1983; Massin et al., in press; Yassine et al., 2007). Research has shown that the hemagglutinin of some of these is of human origin and is of the $\alpha 2,6$ type (Yassine et al., 2007).*
 - *Hemagglutinin from the 2009 A (H1N1) viruses shows an affinity for $\alpha 2,6$ cell receptors (Maines et al., 2009). However, the current experimental data mentioned at the beginning of the discussion suggest that the replication of these viruses is ineffective in the avian cells of the species concerned. The various species of poultry infected experimentally (chickens, turkeys, ducks and quail) did not shed viruses or only shed them for short periods and insufficiently for effective distribution to healthy poultry of the same species with which they came into contact.*
 - *The fact that no distribution of viruses was detected suggests that, in the current state of our knowledge, the aforementioned species of poultry can be said to play only a minor or even non-existent role in the maintenance in circulation (or the distribution) of the 2009 A (H1N1) virus.*
 - *At this time, in poultry, the risk of the circulation of the 2009 A (H1N1) virus with its corresponding distribution can therefore be evaluated as being between zero and close to zero.*
 - *Considering the high frequency of mutations in influenza viruses, generating viral sub-populations whose respective proportions are likely to vary according to the conditions of replication, it is impossible to predict the mutations which could emerge and be selected, or the possible effects on the virus's biological characteristics. This is why it remains indispensable to have permanent surveillance of the evolution of viruses detected in different animal species, including domestic poultry, by certified reference laboratories.*

- *In addition, the primary condition (necessary but not sufficient) for a new reassortant virus to emerge is the co-infection of a given cell by two different viruses. It currently seems highly improbable that a reassortant virus derived from a parental 2009 A (H1N1) virus could emerge from a cell in one of the aforementioned avian species considering, on the one hand, the affinity of this virus for SA receptors attached with an α 2,6 linkage, and the restrictions on replication of 2009 A (H1N1) influenza viruses observed in the in vivo experimental reproduction tests mentioned above and, on the other hand, the preference shown by strictly avian viruses (all of whose genes are of avian origin, particularly the gene that codes hemagglutinin) for SA receptors attached with an α 2,3 linkage. Concerning the particular case of the H5N1 HP virus, in countries where this has become enzootic in poultry and where the 2009 A (H1N1) virus has circulated in the human population, with close contact between poultry and humans, no cases of co-infection or reassortment between these two viruses has been reported, either in man or in poultry.*
- *Since the first stages of the replication cycle of the 2009 A (H1N1) virus can occur in several avian cells (attachment and penetration of the virus into the cell followed by liberation of the viral RNA), we cannot exclude the possibility that in these cells, genes can be exchanged with isolated viruses of avian species that belong to swine or human strains, targeting the same cells. Indeed, the existence of isolated avian viruses (turkeys and wild ducks), with respectively a complete swine and a complete human genome has already been reported (Massin et al., in press). However, such viruses have rarely been described in avian species. In addition, since little is still known about the molecular bases for the generation of reassortant viruses in birds, it would be hazardous to make predictions about the possibility of reassortants emerging in poultry composed of genes of different origins.*
- *In view of the information currently available, the 'Avian Influenza' and 'Swine Influenza' emergency assessment collective groups consider that at this time the risk of co-infection of poultry with a strictly avian influenza virus together with a 2009 A (H1N1) virus can be evaluated as close to zero and that the risk of reassortment of these viruses within a given cell can be evaluated as between zero and close to zero. Nevertheless, we cannot totally exclude the possibility, especially in turkeys, of the emergence of a new reassortant virus resulting from co-infection of the same cells by the 2009 A (H1N1) virus and an avian virus whose origin is in swine, nor can we qualify the corresponding risk.*

d) "Do these different risks vary according to the species in question?"

Considering the elements developed above, the risk for ducks would seem to be zero as long as the 2009 A (H1N1) viruses retain a marked affinity for α 2,6 SAs.

The risk for minor poultry species (farmed partridge and pheasant, guinea fowl, ostrich and pigeon) are unknown, as they have not been studied in experimental reproduction circumstances.

For turkeys and chickens, the differences in the risks as assessed are discussed above.

*It would be worthwhile, however, to **re-evaluate these risks in the light of any new virological, experimental or epidemiological information.***

2°/ Protection of poultry farms against contamination with the 2009 A (H1N1) virus

- a) "Is the objective of preventing poultry farms from being contaminated justified given the public health risk ? Should this objective include all poultry farms or just those with certain species?"
- *In view of the experimental data available and presented in section 1°/b of this Opinion, the risk of human contamination from poultry species (mentioned in 1°/a and*

1°/b) infected with the 2009 A (H1N1) virus may be considered as zero or close to zero.

- However, considering the discrepancies between field data from Chile and Canada and the data resulting from experimental infections, the 'Avian Influenza' and 'Swine Influenza' emergency assessment collective groups consider that the objective of preventing the infection of poultry farms is relevant, particularly for turkeys and quails.

- b) "In the light of the answers to the previous questions, is it relevant to recommend that farmers and professionals in poultry sectors with clinical symptoms corresponding to the definition of possible cases of infection by the 2009 A (H1N1) influenza virus according to the French Institute for Public Health Surveillance (InVS) avoid all contact with poultry (or only with some species of poultry)? In this context, might the wearing of a surgical mask be an effective way of preventing animals from being contaminated by people? Are there any other specific biosecurity measures which could be recommended to poultry farmers in general and particularly when the farmers themselves have clinical symptoms indicating a possible case of infection by the 2009 A (H1N1) influenza virus?"

- As indicated in AFSSA's Opinion no. 2009-SA-0230 and detailed above in section 1°/c, because of the receptivity of certain species of poultry to the human and swine influenza viruses, particularly turkeys and quails, the 'Avian Influenza' and 'Swine Influenza' emergency assessment collective groups consider it necessary to reinforce the application of the general biosecurity measures wherever these species are farmed in France.

- The specific measures to be implemented in these livestock farms regarding the risk of infection by the 2009 A (H1N1) influenza virus should be similar to those recommended for pig farms in AFSSA's Opinion no. 2009-SA-0230, particularly concerning farm workers suspected of being infected with this virus, by limiting the contact they should have with the relevant livestock and, if such contact is unavoidable, by recommending that they wear masks, suitable clothing and gloves.

- For mixed livestock farms, where pigs coexist with particularly sensitive or receptive poultry species (especially turkeys and quails), the members of the 'Avian Influenza' and 'Swine Influenza' emergency assessment collective groups emphasise the importance of keeping the farm workers and equipment used with each species in these farms quite separate, so as to keep them as distinct and independent epidemiological units and thus avoid any viral circulation from one stock barn to another.

- c) "Should the vaccination of people in contact with poultry (farmers, veterinarians, farm workers) against the new virus be a priority objective once the vaccine is available in France ?"

- In its Opinion no. 2009-SA-0230 concerning the epidemiological usefulness of vaccinating personnel working on pig farms in France, AFSSA argued that it would:
 - limit the exposure of pig farms to the 2009 A (H1N1) influenza virus which is now circulating as a pandemic, in order to avoid co-infection by this virus and by enzootic SIVs in circulation in the swine population, a situation favouring reassortments;
 - protect human populations against a possible return of this virus after passage in pigs, where it could have undergone possible modifications of its pathogenic characteristics."

- The results of the experimental studies discussed in this Opinion tend to show that the 2009 A (H1N1) influenza virus is poorly adapted to the poultry species studied, that it is not transmitted efficiently between these animals and that the risk of co-infection for these species is zero or close to zero.
- Furthermore, the risk of transmission of the 2009 A (H1N1) influenza virus from infected poultry (belonging to the species studied) to man was assessed as zero to close to zero in section 1°b.
- The 'Avian Influenza' and 'Swine Influenza' emergency assessment collective groups therefore consider as **not relevant** the objective of **priority** vaccination for these categories of farm workers in view of the risk presented by the 2009 A (H1N1) influenza virus in the species of poultry studied, as for the other poultry species. These categories of farm workers should therefore be vaccinated in the same way as the rest of the general population, in accordance with the recommendations for the use of pandemic vaccines against the 2009 A (H1N1) influenza virus issued by the High Council for Public Health.

3° Surveillance measures

- a) "Given the Chilean case, is the particular surveillance of poultry farms (or certain poultry species) justified?"

As AFSSA indicated in its Opinion no. 2009-SA-0229, clinical surveillance should be applied to turkey and quail farms, especially if they are in close proximity to an outbreak of swine influenza or affected by any suspected human infection with the 2009 A (H1N1) influenza virus, considering the sensitivity or receptivity of these avian species (Andral et al., 1984; Hinshaw et al., 1983; Jestin V., data from the National Reference Laboratory for avian influenza, personal communication, September 2009; Swayne, 2009). Any suspicious clinical symptoms, particularly a drop in laying rates in breeding flocks (AFSSA, 2008), should therefore lead to samples being taken for virological analysis.

- b) "Should the surveillance measures take into account the epidemiological factor (i.e. the existence of a human case of infection by the 2009 A (H1N1) influenza virus in relation to poultry farming), as has been suggested for the surveillance of pig farms?"

- The 'Avian Influenza' and 'Swine Influenza' emergency assessment collective groups consider that it would be relevant to continue applying surveillance measures for influenza viruses in avian species as they have already been implemented in France.
- When it has been confirmed that a person working in contact with poultry has become infected with the 2009 A (H1N1) influenza virus, the members of the emergency assessment collective groups also recommend:
 - clinical surveillance of any respiratory conditions in the poultry, or drop in laying rates, whatever the species under consideration;
 - in the event of suspicion of infection of the poultry with this virus, samples from the farm should be analysed to confirm or disprove the presence of any influenza virus, and then of the 2009 A (H1N1) influenza virus, with the help of the network of accredited laboratories already set up for avian influenza and the National Reference Laboratory for avian influenza;
 - in the event of confirmation that the poultry is infected with the 2009 A (H1N1) influenza virus(es), the recommendation in Section 4a will apply.

4°/ Control measures in the event of the 2009 A (H1N1) influenza virus being identified in poultry

- a) "Which measures should be recommended if the 2009 A (H1N1) influenza virus is detected on a poultry farm? Should these measures depend on the species in question?"
- *The members of the 'Avian Influenza' and 'Swine Influenza' emergency assessment collective groups recommend that, in accordance with best practice in livestock farming, no poultry should leave the site of the outbreak for other livestock farms while the influenza symptoms are apparent (drop in laying rate and/or respiratory symptoms) or during the seven days following the disappearance of these symptoms. Poultry may leave, however, before recovery of normal laying rates, once two successive virological inspections by RT-PCR have tested negative for the virus.*
- b) "Which preventive measures should be recommended to those people who are the most exposed by their work (farmers, veterinarians, technicians and farm workers) and who have been or are in contact with animals likely to be infected by the 2009 A (H1N1) influenza virus in the case of an outbreak on a farm?"
- *Both sanitary and medical preventive measures should be considered for those people who are the most exposed by their work in the event of an outbreak of the 2009 A (H1N1) influenza virus on poultry farms.*
 - **Sanitary measures:** *the classic measures for best practice in farm hygiene must be recommended (wearing suitable masks and protective clothing specific to each livestock production, using gloves and ensuring that farm workers and equipment used for different animals on mixed livestock farms remain strictly apart).*
 - **Medical prophylactic measures:** *the same arguments and conclusions apply as those listed in section 2°c of this Opinion."*

These are AFSSA's conclusions on the relevance of various measures to be implemented on poultry farms following its assessment of the latest information available concerning the epidemiology of infections by the 2009 A (H1N1) influenza virus.

Director General of the
French Food Safety Agency

Marc MORTUREUX

Keywords: *influenza, poultry, turkeys, quails, 2009 A (H1N1) influenza virus, surveillance, transmission, experimental infections*

ANNEXE
Main bibliographical references

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