



TECHNICAL REPORT

ECDC SCIENTIFIC ADVICE

**Avian Influenza A/H5N1 in
Bathing and Potable (Drinking) Water
and Risks to Human Health
Version June 2006**

Avian Influenza A/H5N1 in Bathing and Potable (Drinking) Water and Risks to Human Health

1. Summary

Avian influenza type A/H5N1 is an animal influenza virus poorly adapted to humans. That is it does not infect humans easily, certainly not at low dose exposure. Those humans at risk in Europe are those with close direct contact with ill infected birds and bird products (mostly domestic poultry).

Some wild birds with the H5N1 virus have been found in Europe, mostly these are waterfowl (swans, ducks, geese etc). Though the numbers of birds being found with infection has of late declined greatly concern has been expressed that wildfowl defecating live virus into or around water sources and recreational waters might be a health hazard for humans who are bathing in the waters, or drinking tap or bottled drinking water originally derived from those sources.

Presence of a virus does not equal risk to human health, especially with a virus that does not infect humans easily. There is only scanty and circumstantial evidence that H5N1, or any other viruses than are poorly adapted to humans can be acquired by humans through drinking or bathing in water. The appearance of H5N1 in some wild birds in Europe is not considered by ECDC to increase any residual risks to health from drinking waters in Europe. Current standard practice in providing tap or bottled drinking water through centralized water-supply undertakings in Europe and pre-existing European Union directives if enacted will protect against pathogens that could come through drinking water. Somewhat more vulnerable are the private wells or private water sources in single-family houses and summer cottages but even then the risk from H5N1 is almost non-existent because of the poor adaptation of the virus to humans. The risk to human health in those waters is from other pathogens better adapted to humans, not H5N1.

Concerning bathing there is in ECDC's expert view no additional risk to human health from the occasional presence of H5N1 in the environment from wild birds. Again this is because of the poor adaptation of the virus to humans and the dilution effects in large bodies of water. Current standards like those of the EU European Bathing Water Directives (1976 and 2006) if enacted will assist in making bathing in non-treated waters safer but through reducing the risk of other human pathogens (such as

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salmonella and campylobacter) not through further reducing the risk from H5N1 since these are already close to zero.

Hence the conclusion of ECDC is that there is no additional risk to health from drinking water or bathing in Europe since the emergence of avian influenza A/H5N1 in birds in Europe. This view is consistent with other risk assessments undertaken by national authorities in Europe.

These views are interim would need to be rapidly reviewed and a more precautionary approach taken if convincing evidence emerged that H5N1 had adapting better to humans.

Some work is recommended by ECDC. This includes that guidance might usefully be prepared on what action to take over bathing recommendations when there are abnormal numbers of dead birds reported in bathing waters. Though ECDC does not see any scientific case for suspending bathing should the deaths be attributed to H5N1. This guidance would best be prepared by the European Commission to ensure that it is consistent with other relevant guidance on bathing and responding to cases of H5N1 in animals. Some research should be undertaken to investigate possible infection human health risks from bird faeces in or around bathing areas and beaches. This would be to detect pathogens that are better adapted to humans than H5N1.

2. Scientific and Public Health Considerations

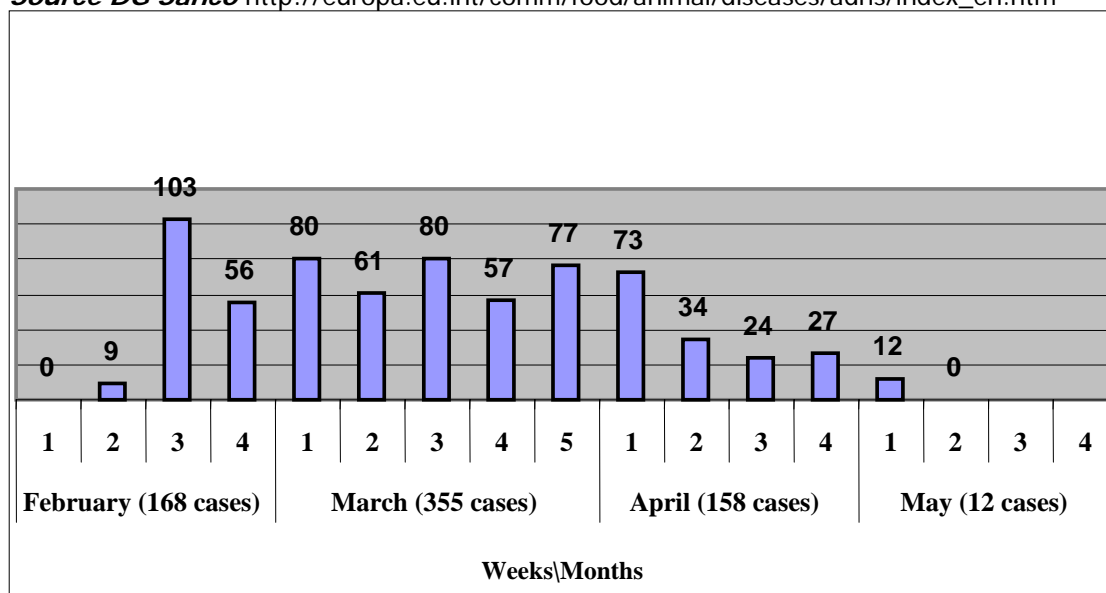
Hazard Identification

Influenza type A/H5N1 at present is a highly pathogenic avian influenza (HPAI) that only occasionally infects humans, though then with serious effect. Hence it has been characterized as *"a bird flu virus, poorly adapted to humans for whom it is not very infectious, but highly pathogenic in those few humans it infects, though then it generally does not transmit on to others"*¹ The scientific knowledge of precisely how it behaves with humans, how infection is acquired, how it enters the body and who is at risk of infection remains incomplete.²

The virus has changed significantly in its behavior in birds since it was first observed in the 1990s with the establishment of one relatively unchanging variant.^{3,4,5} It has been stated that this variant is somewhat more persistent in the environment^{4,5} The fact that that live and dead H5N1 infected waterfowl have been found in some European countries earlier this year (see DG Sanco map⁶) has led to concerns in Europe that the virus might possibly be acquired from bathing in open water or drinking water sourced from open water. The concern about bathing may be especially felt in countries where lake and sea bathing are common in the warmer months of the year. Reports of H5N1 in birds in Europe declined steeply in April and May (Figure). Occasional infected birds are still being detected and ECDC was asked to undertake this risk assessment by member states and the Commission.

Figure. Highly Pathogenic Avian Influenza (H5N1) in birds reported in the European Union through the Animal Disease Notification System February to mid May 2006

Source DG Sanco http://europa.eu.int/comm/food/animal/diseases/adns/index_en.htm



The Scientific Evidence

Presence of the virus in the environment does not equal risk to humans, especially with a virus that is poorly adapted to humans and mostly seems to transmit where there is intense and close exposure.^{1,7} There are a limited number of case reports where it is suggested that humans with H5N1 infections in Asia may have acquired their infection from bathing or swimming in water (Van Tam J, HPA Personal Communication). For example one fatal case in Vietnam was reported to have perhaps been infected through this route having seemingly had no other bird exposure than regular swimming in a canal inhabited by ducks.^{8,9}

However investigations of these cases have generally been incomplete.¹⁰ Enquiries with relevant authorities in the Western Pacific Region of WHO indicate that in all of these few cases swimming was not the only possible exposures, that it was not documented whether or not the water was contaminated with H5N1 and that such risk behaviors are common and so are likely to be reported in case investigations by chance alone (Brown R, WHO Viet Nam personal communication). Hence, it cannot be concluded that this was the route of transmission in these cases. On a precautionary basis WHO issued guidance in late 2004 for SE Asia indicating that potable (drinking) water supplies for human use should not be drawn from open ponds used by domestic ducks and used untreated and should be stored in ways that prevent contact with ducks. However WHO did not identify bathing in water as a risk to health where H5N1 might be in waterfowl.¹¹

There are no prior data suggesting that other avian influenzas have ever been acquired by humans through drinking or swimming. This is unlike other viruses known to be occasionally transmitted to humans by this route (hepatitis A & E and certain human enteroviruses).

Even though the current H5N1 virus may be more persistent in the environment than its predecessors that does not mean that risk of human acquisition has increased. Even if the virus was well adapted to humans, which it is not, the virus would be very much diluted in the water. Also for water going for drinking supplies the processes of treatment required would inactivate the virus.¹² There is also some evidence from the recent outbreaks that birds with H5N1 infection do not express virus so well in their faeces as in their respiratory tract. This is different from other avian influenza viruses (Beer M, Fredrich Loeffler Institute, Personal Communication). There may be a higher concentration of virus in duck faeces itself and this deserves further investigation.

Infections that Humans Do Acquire from Water

People do acquire infections from bathing in or drinking impure water especially if located near contaminating sewage water sources. However these are infections that are better adapted to humans than H5N1 is at present.^{13,14} Both gastrointestinal infections and acute febrile respiratory infections have been shown to be associated with swimming in sea water contaminated with faecal pollution as indexed by relatively harmless faecal indicator bacteria. Worldwide most of the infections are occurring in resource-poor settings but infections from bathing and drinking water also take place in the most well-resourced countries.^{13,14} However with some notable exceptions, such as leptospirosis most of these are infections where the origin of the organism is an infection in another human not an animal. A universal feature is that these all infections are well adapted to humans. For example one important pathogen that is probably acquired from exposure to or drinking impure water is campylobacter. However unlike H5N1 it is well adapted to both human and animal hosts.¹⁵

ECDC's specialists and those experts it has consulted cannot as yet identify any case reports of an animal viral infection that is poorly adapted to humans that have been acquired by a human from bathing in or drinking water. There are many examples of human viruses (e.g. norovirus from one toddler to another in paddling pools) and some viruses that are well adapted to both humans and animals (Hepatitis E), but not viruses that are almost entirely animal viruses.¹³

It is possible that, with high doses of virus the species barrier could be breached. That is what is thought to have happened in the cases where humans have been infected with H5N1 through close and intimate contact with domestic poultry.² However when introduced into bathing water H5N1 will be diluted far too much for any transmission risk to humans.¹⁶ There is concern that in some waterfowl faeces viruses could remain concentrated. When exposure takes place to bird faeces then good personal hygiene should be practiced (washing hands, cleaning feet and shoes etc). Children will need particular instruction in these practices.¹⁷

Potential Hazards from Drinking Water

Providing safe potable (drinking) water for the population is the goal of all countries. If there is concern here, it is of a low risk of spread of infection to commercial and domestic poultry flocks through this route, not to humans.¹⁶ The risk assessment undertaken by the Netherlands assumed a low virus infectivity to humans found that the average daily infection risk for humans by consumption of contaminated drinking water was estimated to be close to zero (2×10^{-12}). Risk was reduced by effective

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drinking water treatment, and the risk from surface water recreation scarcely any higher (10^{-8}).¹⁶

Comparison with Other Risk Assessments

This risk assessment's conclusions are consistent with others that have been conducted in Europe to date. These have concluded that the current treatment and disinfection mechanisms will eliminate any risk to human health from H5N1 in its current form.^{16,18} Where water-supply undertakings provide ground water without treatment, there may be enhanced risk as there could be for consumers of inadequately treated private water supplies. Again, however, the currently 'unadapted' form of the H5N1 virus presents a minimal threat to humans. The real risk from drinking such water is from other pathogens which are adapted to humans and may be acquired from these water sources. The risks of these is minimized by the application of the relevant European Directives.^{19,20}

Hazards from Bathing and Swimming in Untreated Water

Bathing, diving and swimming in untreated waters in lakes, estuaries and the seaside can be hazardous to humans with one of the hazards being acquiring infections.²¹ This has been recognized for many years at an EU level and is one of the prime reasons for the 1976 Bathing Water Directive.²² In February this year the EU Parliament adopted a new directive with a view to steadily improving the safety of bathing waters in Europe, replacing the earlier 1976 Directive. The aims of both Directives was to reduce the potential infection risk from bathing in Europe's surface waters.^{23,24} At one extreme it is clearly hazardous to bathe or dive in what is effectively sewage or heavily polluted waters.^{25,26,27} Equally, however, it would seem unreasonable to insist that all bathing waters achieve that same standards as apply in commercial indoor swimming pools which are commonly chemically disinfected. Important components envisaged in the new Directive are the monitoring and classification of bathing water quality and management. Management measures include, among others, timely and adequate measures to be taken in unexpected situations that have, or could reasonably be expected to have, an adverse impact on bathing water quality and bather's health. In this case, a temporary bathing prohibition may be put in place.

Enactment of the standards in the 1976 Bathing Water Directive improves protection against significant threats from pathogens that are well adapted to humans. These include human viruses, protozoan parasites and bacteria such as *E. Coli* O157 and *Campylobacter*.¹³ Some of the non-viral pathogens will be animal derived. Therefore for these reasons alone the 1976 and 2006 Directives deserve strong support and

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proper enactment by all EU countries. However it cannot be stated that the Directives will further reduce the risk from H5N1 in bathing waters since that is close to zero already.

Comparison with Other Risk Assessments

Such an analysis is consistent with the conclusions of the three published national risk assessments in Europe,^{16,18, 28} Namely that the individual additional risk from H5N1 to individuals bathing in recreational waters in Europe is negligible.²⁹

Responding to Bird Deaths

An important question is what to do when H5N1 is detected in wildbirds in Europe and specifically they are found in lakes where people bathe.^{6,30} Or even what to do when birds are found dead in water? There would be advantages to having standard EU guidance on this. An ECDC scientific panel has suggested that where there are abnormal numbers of dead birds they should be reported and investigated as recommended by the European Commission but that recreational swimming should be suspended in that water until tests are completed.³¹ This would be equivalent to dealing with a suspected acute escape of sewage and is well in line with the existing and new bathing directives. However given the lack of risk from H5N1 there would in ECDC's view be no real scientific reason for such suspension of bathing and little justification of testing for H5N1 in the water, which is not easy technically (M.Beer, Robert Loeffler Institute, Personal Communication). Also the numbers of H5N1 infected birds detected though surveillance has declined steeply in April and May (Figure). ECDC notes that the country that is most affected in the EU (Germany) is generally not suspending water bathing where birds have died from H5N1. ECDC would support suggestions from its Panel that additional research is needed. One issue is to look at the infection risks from human pathogens bird faeces that are found in and around bathing and recreational water and may be encountered by children in particular.

General Hygiene Considerations

Bathing in untreated water in lakes and the sea can carry infection risks for humans, though not from H5N1. Care should be taken that people are aware of these risks and particularly that hands are washed after bathing before eating or drinking. Also it is important that food hygiene be well practiced as standards may slip when eating food in recreational settings. When exposure takes place to bird faeces then good

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personal hygiene should be practiced (washing hands, cleaning feet and shoes etc). Children will need particular instruction in these practices.¹⁷

3. Conclusions and Cautions

This view is interim. It has especially to be so with an influenza because of these viruses ability to change their structure and behaviours. H5N1 has seemingly changed its behavior in birds since its emergence in 1997. However though the evidence is scanty, so far H5N1 has not changed in its behavior towards humans since the first human cases were also observed in 1997.¹ Should evidence emerge that the virus was adapting better to humans and so becoming more infectious then a more precautionary view should prevail and swimming might need to be confined to treated waters while further urgent risk assessments were undertaken.

Until more information is gathered recommendations and decisions have to be based on what the current evidence and what experience indicates. That is that this virus (A/H5N1) does not infect humans easily and that the dilution and natural inactivation of the virus in bathing water will further reduce the dose and any infectivity. Also the numbers of H5N1 infected birds detected though surveillance has declined steeply in April and May. Similarly normal treatment of drinking water in Europe can be expected to be effective against H5N1. Hence the ECDC conclusion it that the introduction of H5N1 in European bathing in EU waters will not increase any residual risks of infection from bathing and drinking. ECDC would emphasize the current Bathing Water Directive Standards and the Directives relating to drinking water should be applied but emphasizes that this is to protect against other established threats, mostly human pathogens not against H5N1. The European Commission should consider whether to prepare guidance for Member States on how to respond when bird deaths in water leads to the suspicion that H5N1 may be present, or it is actually confirmed. However this guidance would be to ensure standard responses across Europe (and to prevent the anxiety caused by different responses in different countries) not because there was any additional risk to human health from H5N1.

Some further research should be undertaken. Consideration should be given to undertake investigations into the existence and persistence of the virus around the current outbreaks in birds in Europe. Perhaps of more importance given some public concern about bird faeces at bathing sites there should be investigation as to any microbiological risk from these though this will be mostly looking for microorganisms better adapted to humans, not H5N1.

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