

# Circulation of other avian influenza viruses with zoonotic potential



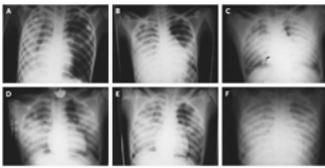
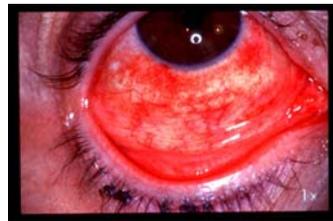
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## Zoonotic potential?

- Zoonosis : also called *zoonotic disease* refers to diseases that can be passed from animals, whether wild or domesticated, to humans
- Potential: existing in possibility, expected to become or to be

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**Table 1.2** Cases of human infection caused by avian influenza viruses (1959 to September 30, 2007)

Year	Country	Subtype	Number infected	Number deaths	Symptoms	Reference
1959	USA	H7N7	1	0	Hepatitis?	Campbell et al. (1970)
1977	Australia	H7N7	1	0	Conjunctivitis	Taylor and Turner (1977)
1981	USA	H7N7	1	0	Conjunctivitis	Wobser et al. (1981)
1996	England	H7N7	1	0	Conjunctivitis	Koene et al. (1996)
1997	China	H5N1	18	8	Influenza like illness	Chan et al. (2002)
1999	China	H9N2	2	0	Influenza like illness	Paris et al. (1999)
2002	USA	H7N2	1	0	Serological evidence	CDC website
	China	H5N1	2	1	Influenza like illness	CDC website
		H9N2	1	0	Influenza like illness	Bost et al. (2005) N
2003	The Netherlands	H7N7	89	1	Conjunctivitis	CDC website
	USA	H7N2	1	0	Influenza like illness	CDC website
	Viet Nam	H5N1	3	3	Influenza like illness	WHO website
	China	H5N1	1	1	Influenza like illness	WHO website
	Italy	H7N3	7	0	Serological evidence	Punelli et al. (2005)
2004	Canada	H7N3	2	0	Influenza like illness	CDC website
	Thailand	H5N1	17	12	Influenza like illness	WHO website
	Viet Nam	H5N1	29	20	Influenza like illness	WHO website
2005	Cambodia	H5N1	4	4	Influenza like illness	WHO website
	China	H5N1	8	5	Influenza like illness	WHO website
	Indonesia	H5N1	20	13	Influenza like illness	WHO website
	Thailand	H5N1	5	2	Influenza like illness	WHO website
	Viet Nam	H5N1	61	19	Influenza like illness	WHO website
2006	Azerbaijan	H5N1	8	5	Influenza like illness	WHO website
	Cambodia	H5N1	2	2	Influenza like illness	WHO website
	China	H5N1	13	8	Influenza like illness	WHO website
2006	Djibouti	H5N1	1	0	Influenza like illness	WHO website
	Egypt	H5N1	18	10	Influenza like illness	WHO website
	Indonesia	H5N1	53	45	Influenza like illness	WHO website
	Iraq	H5N1	3	2	Influenza like illness	WHO website
	Thailand	H5N1	3	3	Influenza like illness	WHO website
	Turkey	H5N1	12	4	Influenza like illness	WHO website
September	Cambodia	H5N1	1	1	Influenza like illness	WHO website
	China	H5N1	2	1	Influenza like illness	WHO website
2007	Egypt	H5N1	16	3	Influenza like illness	WHO website
	Indonesia	H5N1	6	5	Influenza like illness	WHO website
	Laos People's Democratic Republic	H5N1	2	2	Influenza like illness	WHO website
	Nigeria	H5N1	1	1	Influenza like illness	WHO website
	Vietnam	H5N1	7	4	Influenza like illness	WHO website
				179		
				417		

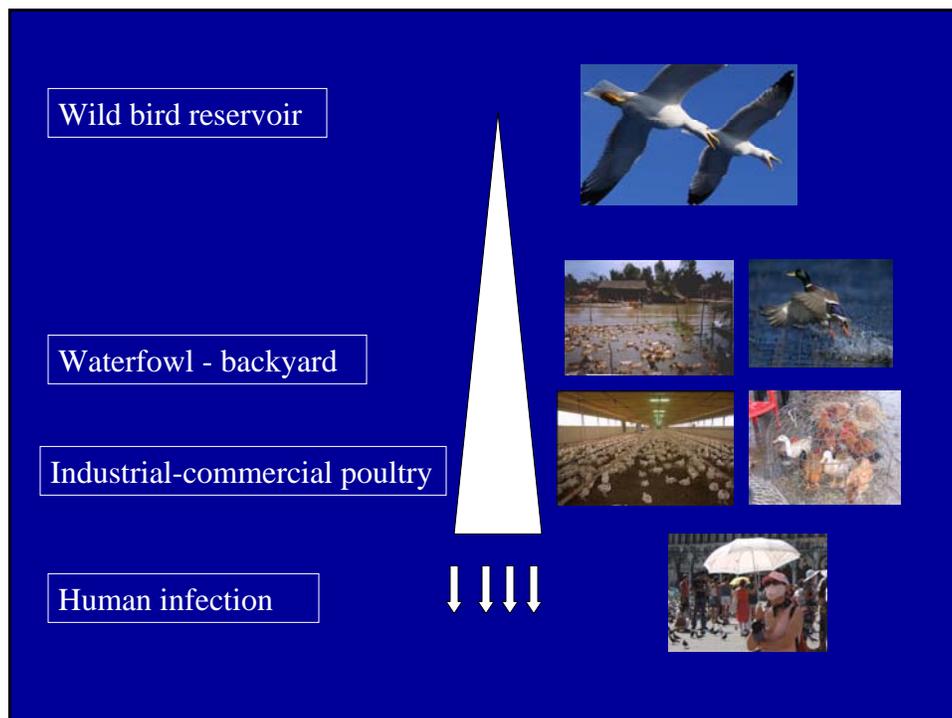
Cases of human infection with AI Virus  
1959-2007

Cases of human infection with AI Viruses other than H5N1 (1999-2007)

Year	Country	Strain	Pathotype	Clinical signs
1999	China e Hong Kong	H9N2	LPAI	Respiratory infection
2002	Virginia USA	H7N2	LPAI	seroconversion
2003	Netherlands	H7N7	HPAI	Fatal case
2003	New York, USA	H7N2	LPAI	Respiratory infection
2004	Canada	H7N3	HPAI	Conjunctivitis
2006	UK	H7N3	LPAI	Conjunctivities
2007	UK	H7N2	LPAI	Respiratory infection

## Characteristics in common

- All belonging to H5N1, H7 or H9N2 subtypes
- All widespread in poultry population at the time of occurrence of the human case
- All (presumably) had a wild bird progenitor



## Human infection associated to H7-H9 infections

- Significant amount of virus circulating in the poultry population (multiple species?)
- Laboratory / animal husbandry accidents
- All H7 cases were diagnosed in developed countries, mostly as a result of “increased attention” to ILI or conjunctivitis in people associated with outbreaks

## H7 viruses infecting humans

- Both LP and HP for poultry
- Documented human cases by H7N2, H7N3, H7N7 belonging to different lineages
- Human cases detected only in Europe and US
- H7 viruses have also circulated (extensively) in Pakistan, North Korea, South Korea and... ?

## H9N2 viruses infecting humans

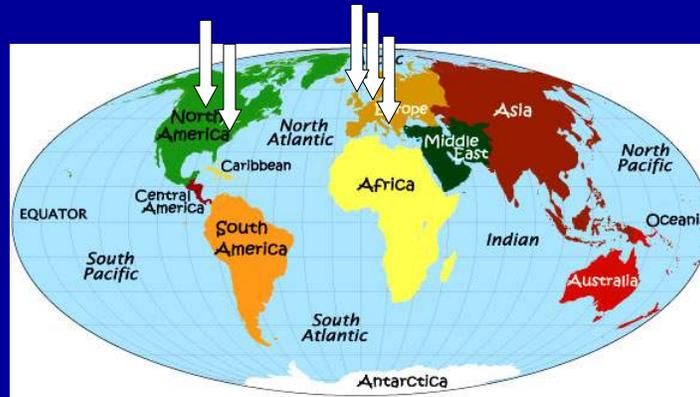
- LP for poultry
- Documented human cases only in China in late '90s
- H9 subtype viruses are NOT notifiable to the OIE
- H9N2 viruses are currently widespread in Middle and Far East. Have also circulated (are still?) in South America (Colombia)
- Under-reporting of animal (and human?) cases

## Conclusion on zoonotic potential of H5, H7, H9 viruses /1

- Infection in humans is mostly related to extensive virus circulation in commercial poultry
- To date only one subtype of H5 and one subtype of H9 have infected humans. Within these subtypes, all 8 genes were phylogenetically related
- Human outbreaks of H7 viruses have been caused by a variety of different subtypes and from genetically very diverse strains

## Both Eurasian and American lineage H7 viruses

H7 subtype virus infection in humans



## Conclusion on zoonotic potential of H5, H7, H9 viruses /2

- H7 subtype virus outbreaks infecting humans that have occurred in Western countries have been put under control and eradicated
- There seems to have been no spill over to humans of H7 viruses circulating in developing countries
- H5N1 and H9N2 are widespread in countries that have a weak veterinary infrastructure, this has certainly contributed to the generation of an endemic situation

## What if....

- The Dutch H7N7 HP virus had emerged in South-East Asia? Would it have caused more fatal cases and become widespread in the human population?
- Would we be focussing more research efforts on H7 viruses?

## H1, H2, H3 subtype viruses

- Are NOT notifiable in poultry, and generally cause inapparent or mild disease which may go undiagnosed
- Cause sporadic outbreaks in birds and in certain instances have become widespread
- Have been put under control, also through vaccination
- Except for Spanish H1N1 have not infected humans directly (?)

## H1, H2, H3 subtype viruses

- Avian-like haemagglutinins (and other genes) have contributed to the generation of human pandemic viruses through reassortment
- Since they are not notifiable and clinically irrelevant in birds it is unknown whether they were widespread at the time in poultry

## Other avian influenza subtypes H4, H6, H8, H10, H11, H12, H13, H14, H15, H16

- There is some evidence of seroconversion in humans to other avian influenza subtypes
- Viruses have never been isolated from humans
- With the exception of self-limiting outbreaks of H10 and some episodes of H6, these subtypes circulate mainly in wild birds
- Have we ever looked for H6 and H10 antibodies in humans associated with outbreaks in poultry?

## Summary on zoonotic potential of AI viruses

- In most cases amplification in poultry is a prerequisite to human infection
- Apart from H5N1 and a limited occurrence of H9N2, diagnosed human cases have been caused by a variety of H7 subtype viruses occurring in Western countries
- Insufficient information on other subtypes infecting humans

## Summary on zoonotic potential of AI viruses/2

- Management of AI in the avian reservoir is a prerequisite to optimizing pandemic preparedness efforts
- Comparison of genetic characteristics of avian viruses in the avian reservoir to viruses that spill over to the mammalian host is essential to improve our understanding on the zoonotic potential of AI viruses
- As a result of surveillance efforts for H5N1 there are hundreds of avian viruses that have been isolated worldwide

## Perhaps....

- Among these we should prioritise sequencing other H5,H7,H9 and H1, H2, H3 subtypes
- We should find a way to make H9, H1, H2, H3 “notifiable” or “reportable” without imposing restriction policies on poultry farms
- The epidemiological situation in animals of these subtypes could be clarified

## Issues to think about

- Are we looking well enough in humans exposed to avian viruses of subtypes other than H5N1?
- Do we have adequate and suitable diagnostic tests?
- Are there areas that should be monitored more closely?

Are we maximising the use of the  
information we have?



**boeri**  
it's your head