The Extent and Control of Avian Influenza in Canada

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SUMMARY

The large variety of influenza A virus types circulating among wild birds in their northern breeding grounds represents a menace to the Canadian poultry industry. The principal victims of avian influenza in the past were turkeys, exceptionally affected were ducks, but never chickens. Influenza in Ontario turkeys reached a peak incidence at the end of the 60's, then it declined steadily to isolated infrequent infections. The decline is attributed to efforts made to avoid contact between domestic turkeys and wild birds. The prospect of controlling avian influenza by vaccination is discounted, and it is recommended to place more emphasis on isolation of the turkeys and improved sanitation on the farms.

RÉSUMÉ

L'importance et le contrôle de l'influenza aviaire, au Canada

La grande variété de sérotypes du virus A de l'influenza qui circulent chez les oiseaux sauvages, dans leur territoire nordique de reproduction, représente une menace pour l'industrie aviaire canadienne. Dans le passé, les dindes représentaient les principales victimes de l'influenza aviaire; les canards constituaient des victimes exceptionnelles, mais les poulets ne souffrirent jamais de la maladie. En Ontario, l'influenza atteignit un sommet, chez les dindes, à la fin des années 60'; il régressa ensuite de façon constante, jusqu'à ne causer que de rares infections isolées. Ce déclin résulte des efforts déployés pour éliminer tout contact entre les dindes domestiques et les oiseaux sauvages. On rejette la perspective de contrôler l'influenza par la vaccination; on recommande plutôt de mettre l'emphase sur l'isolement des dindes et l'amélioration des conditions sanitaires, sur les fermes.

INTRODUCTION

Recent reports (1,2,3,4,5,6,28,32) indicate that wild birds in their Canadian breeding grounds harbor a large variety of influenza A viruses. Although the predominant virus serotype may change, the extent of infection remains fairly constant from year to year. This enzootic state has probably existed for many years, yet influenza in domestic birds was of little importance in Canada until about 20 years ago. Newcastle disease was the most serious virus disease of poultry, and only one influenza disease case was on record, a nervous disease observed in 1953 in Manitoba ducklings, from which a hemagglutinating agent was isolated by Walker and Bannister (30). This agent's identity as an influenza A virus (Hav2 Neal, or H10 N7 by the new WHO classification of Schild *et al* 27) was determined only 14 years later (15).

The actual emergence of avian influenza as a veterinary problem coincides with the industrialization of poultry husbandry. The concentration of large numbers of young susceptible birds created a very favorable situation for the spread of infectious diseases, in particular those of viral etiology. Also, diseases of relative mildness to the individual bird, generally overlooked at the small family farm with a few backyard fowl, became serious problems on industrial farms when thousands of birds failed to grow, or to lay eggs in accordance with narrow production performance requirements. The tendency of such problems to spread to other flocks added to the poultrymen's alarm, and they sought assistance from veterinary diagnostic services. These laboratories were better equipped to handle the influenza diagnosis because of the introduction of the embryonated hen's egg for virus isolation, and the hemagglutination and hemagglutination-inhibition tests for identification and serodiagnosis. These changes led to the recognition of a steadily increasing number of influenza infections in Canadian domestic poultry since the winter of 1962/63 (Figure 1 and Table I). Most of these occurred in turkeys, very rarely in ducklings, but never in chickens. This is rather surprising, since chickens were the principal victims of the historical fowl plague epizootics in Europe and North America, and because the chicken population is at least ten times more numerous than the turkey population in North America. This peculiar infection pattern of the two species might have its explanation in husbandry practices. Many turkeys are raised on range, or are let out of doors for reasons of management, permitting frequent exposure to influenza virus carrying wild birds. Chickens are kept indoors on industrial farms, and only very few of the freely roaming barnyard fowl remain; if disease or death occurs in the latter, their owners write them off rather than taking the trouble of presenting them at diagnostic laboratories.

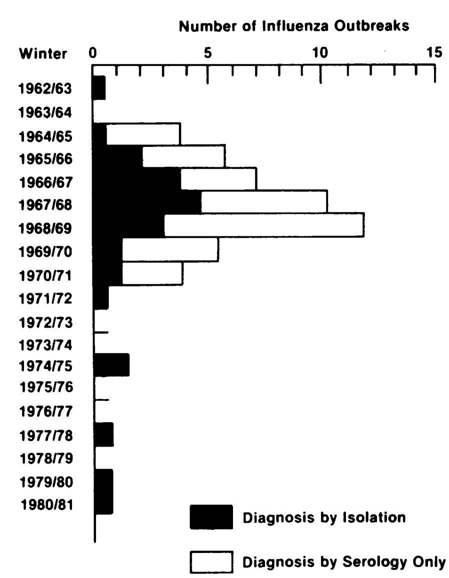

FIGURE 1. Annual frequency of influenza outbreaks in turkeys diagnosed at the Ontario Veterinary College 1962-1980.

TABLE I
ANTIGENIC TYPES IDENTIFIED IN INFLUENZA OUTBREAKS IN CANADIAN POULTRY DIAGNOSED AT THE ONTARIO VETERINARY COLLEGE
1962/63-1980/81

Antigenic Types	Number of Outbreaks Diagnosed by: Virus Isolation	Serology Only
H4 N1	1 (Duck)	
H4 N2	1 (Duck)	
H4 N6	2 (Turkey)	
H5 N1	1 (Turkey)	
H5 N2	4 (3 Turkeys; 1 pheasant)	H5 7 (Turkey)
H5 N9	6 (Turkey)	
H6 N1	7 (Turkey)	
H6 N2	8 (Turkey)	H6 27 (Turkey)
H6 N8	6 (Turkey)	
H8 N4	1 (Turkey)	
H9 N2	1 (Turkey)	
Number of Outbreaks	38	34 Total 72

The data presented reflect essentially the situation in Ontario, where about 40% of the poultry industry in Canada is located. Disease reports at the Ontario Veterinary College list 72 influenza outbreaks in poultry from the early 60's to the early 80's (7,8,9, 11,12,13,16,23,26,33). Influenza in turkeys was diagnosed almost every year during the first decade, then declined progressively during the second decade to a level of insignificance, although turkey farmers were by then well aware of the influenza problem, and other areas in North America registered an exacerbation of the influenza rate in turkeys. Initial assumptions that the influenza viruses were circulating in the turkey population, as influenza viruses do in humans, horses and swine, could not be confirmed, and egg transmission of the viruses was not observed. Influenza recurred on large turkey farms, but the infecting viruses were of various antigenic types (Table II), indicating that they must have been introduced onto the premises from outside sources. Experience on turkey farms indicates that routine sanitation instituted after an outbreak suffices to eliminate the virus from the premises and no turkey farm was found to be enzootically infected by avian influenza. On duck farms, however, influenze is often enzootic, but complaints from duck farmers were few during the two decades of poultry diagnostic activity covered by this report. Only two instances of duckling mortality investigated yielded influenza viruses, and in both cases pathogenic bacteria were associated with the disease. A third avian species affected by influenza was brought to our attention from Quebec, where pheasants reared on a game farm were stricken by the virus.

THE CONTROL OF AVIAN INFLUENZA

Preventive measures against influenza are aimed mostly at the infection in turkeys and chickens, and vary with the virulence of the viruses involved. According to a proposal made at the recent International Symposium on Avian Influenza (Beltsville, MD, April 22-24, 1981), virulent influenza A viruses, i.e. viruses killing 80% or more young susceptible chickens in transmission experiments, without regard to serotype, should come under the provisions of official fowl plague legislation, and thus are dealt with by government veterinary officials. The common avian influenza viruses, represented by the great majority of field virus isolates, are to be taken care of by the poultry industry. Vaccination has a very strong appeal for poultrymen, but in avian influenza, several considerations argue against its application. The already mentioned investigations on influenza in Canada's wild bird fauna (1,2,3,4,5,6,28,32) stress the rich variety of influenza virus types circulating in this ecosystem. Table III consolidates the data from these studies. It projects the trend of predominant serotypes on the basis of the frequency with which individual hemagglutinin (H) and neuraminidase (N) combinations were detected in isolates. Identified by dark framings are the virus serotypes so far isolated from Canadian poultry. It can be seen, that every H-type listed in the new

TABLE II
SEROTYPES OF INFLUENZA VIRUSES ISOLATED DURING REPEATED OUTBREAKS AT THREE ONTARIO BREEDING ORGANIZATIONS

Turkey Breeder A		
1967 01 20	T/Ontario 6118/67	H8NA
1967 03 03	T/Ontario 6828/67	H5N9
1967 12 11	T/Ontario 4845/67	H6N1
Turkey Breeder B		
1966 01 06	T/Ontario 6213/66	H5N1
1967 11 28	T/Ontario 4689/67	H6N1
1969 12 29	T/Ontario 3849/69	H6N8
1972 11 25	T/Ontario 110/72	H6N8
1975 09 26	T/Ontario 9313/75	H6N2
Turkey Breeder C		
1966 03 20	T/Ontario 7732/66	H5N9
1966 12 12	T/Ontario 5379/66	H6N2
1969 11 28	T/Ontario 3575/66	H6N8
1970 11 18	T/Ontario 3348/66	H6N1
1974 10 21	T/Ontario 8009/74	H6N1
1977 12 07	T/Ontario 1195/77	H6N8

TABLE III
INFLUENZA A SEROTYPES IN CANADIAN BIRDS

HA Types		Neuraminidase Types N1	N2	N3 av2/3	N4 av4	N5 av5	N6 av1	N7 eq1	N8 eq2	N9 av6
	H0	E 144				1				
H1	H1	O								
	HSW	W 52					1		1	
		E	2							
H2	H2	O 1								
		W		2						1
	H3	E 6	26				25	2	59	2
H3	eq2	O 1	1						4	1
	av7	W 1	8	1			35	1	35	1
		E	34				60		30	
H4	av4	O	2				5		1	1
		W 5	8	1	1		228		28	
		E	1							
H5	av5	O	1							
		W	4							
		E 17	7			5	4		78	1
H6	av6	O	2				1		6	
		W	523			1			5	
		E								
H7	av1	O								
	eq1	W		10		1				
		E								
H8	av8	O								
		W			1					
		E								
H9	av9	O								
		W								
		E								1
H10	av2	O								
		W		1				3		
		E								
H11	av3	O	2							
		W								4
		E								
H12	av10	O								
		W				1				

Legend = E: Eastern Canada; O: Ontario; W: Western Canada; Dark Cases: Serotypes found in domestic birds.

influenza virus classification of the World Health Organization (27) has been found in Canadian birds. Since we can assume that every influenza serotype can infect turkeys, a hypothetical vaccination program would require a vaccine encompassing most, if not all H-types, a difficult and costly proposition. It must be considered further, that despite numerous attempts, vaccination has not achieved a lasting reduction of influenza in humans, horses or swine, which in nature are infected by no more than three influenza serotypes, thus should be much easier to protect by immunization. The reason for the poor influenza immunity is the brief life-span of humoral antibodies, which is particularly short in turkeys immunized with inactivated or low virulent live virus preparations (18,20,24,25).

But much more important, the use of live virus vaccines, highly in demand by the poultry industry, raises serious questions of public health concerns. According to present day views, new influenza antigenic and pathogenic types arise by the process of recombination from within the vast reservoir of influenza viruses circulating in the wild birds of the world. Such recombinations could be experimentally produced in strictly controlled studies (31). Millions of turkeys are raised every year in North America, many on open range. Field live virus vaccinations of thousands of birds susceptible to natural infection by practically all influenza viruses, in an environment where so many different virus types occur, are virus recombination experiments on a giant scale, without any control over the results. This may generate new viruses of pathogenic potential not only to the avian species, but also to man, since human exposure is more likely to occur with domestic birds than with wild birds. Virulent influenza viruses were isolated by us from Ontario turkeys (10), and the disease reproducible with these pathogenic virus isolates is probably the nearest counterpart to that reported in humans during the 1918 pandemic (17,19,20,21,22,29). Recently an epizootic in Cape Cod seals, was investigated where many animals died from pneumonia, and an avian-type (H7 N7) influenza virus was isolated not only from lung tissue but also from the brain of many seal carcasses (14). This points strongly to possible transmission of avian influenza viruses to mammals, and may conceivably happen to humans. The chances of this taking place are enormously increased by animal mass vaccinations with live influenza virus. Because of the great risk and little benefit offered by this method, vaccination with live influenza virus of animals in general and domestic birds in particular, should be examined very carefully.

The localization of the influenza virus reservoir in wild birds and its quasi exclusive role as a source of infection for domestic turkeys suggests a more promising method of influenza control on turkey farms, by strictly separating domestic birds from all contact with wild birds. This concept is basically an extension of the 'all in-all out' rule practiced in the commercial poultry industry to break up transmission chains of infectious diseases. The method is being put to the test by us in a research project involving breeding turkeys, the most vulnerable and most critical element for the establishment of an influenza enzootic or epizootic. The participating turkey breeders are two large organizations in Ontario with about half a million turkeys maintained on several farms, and account for about 75% of the yearly hatchery output in the Province. Both organizations have repeatedly experienced influenza in the past. The program calls for HI spot tests with the six prevailing influenza serotypes and four avian paramyxoviruses (1,2,3, and 6) of all replacement flocks at the age of 22 weeks and again during the laying season whenever the egg yield declines markedly. The supervised premises have stayed free of influenza since the beginning of the program in early 1978 until the spring of 1981, when influenza broke out at one farm managed by a new and inexperienced employee. This break underlines the importance of proper training of the personnel in the defensive quarantine strategy since these persons must cooperate fully and play a crucial role in identifying loopholes in the system through which the domestic birds can be exposed to contamination from wild birds. The contamination can take place by direct contact with wild birds and also by contamination of feed bins or straw and other bedding material stored in sheds and barns accessible to free flying birds. The marked reduction in turkey influenza in Ontario has been the most persuasive argument in convincing turkeymen of the validity and practicability of this method, which has the added advantage in reducing infections such as chlamydia, mycoplasma, salmonella and various viruses carried by feral birds.

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LETTER TO THE EDITOR

Early Spay-Neutering of Dogs and Cats

DEAR SIR:

In the 1980 proceedings of the Canadian Veterinary Medical Association (CVMA), Council expressed concern over the lack of conclusion on early spay-neutering of dogs and cats, particularly in the view of the fact that it had received a definite inquiry from the Ottawa Humane Society. Council made a strong recommendation that the Small Animal Practice Committee (SAPC) look into having research done and seek possible sources of funding.

This subject has received much attention for many years now, but no position paper on the pros and cons of early spay-neutering has been prepared. The SAPC of the CVMA took the following approach:

1) Define early spay-neutering. Early spay-neutering is defined herewith as the performing of an ovariohysterectomy on a female dog or cat or a castration on a male dog or cat prior to the age of four months.

2) Contact a random sample of authorities and survey their opinion, in order to arrive at a consensus opinion. In the letters received, the following possible adverse effects were brought out (Table I): perivulvar dermatitis/infantile or atrophied vulva, urinary incontinence, infantile behavior and/or effect on behavioral development, lack of stature development/musculature, increased surgical risk and increased anesthetic risk.

The analysis of the responses by these authorities is confusing. Opposite opinions on the same subject are very frequent. None of these respondants have discussed dermatological problems associated with early spaying.

3) Do a literature search on the subject. With the help of the librarian of the "Faculté de Médecine vétérinaire de l'Université de Montréal" a literature search done by computer revealed that no reference deals directly with sterilization of young dogs and cats. Few references exist about the age of sterilization. Some publications note that undesirable side effects were minimal when surgery was done just before puberty (2, 3). In the bitch, one author states that there can be no doubt, that such an operation should be delayed until after completion of the first estrous cycle (1).

Based on the information gathered it is the opinion of the SAPC that there is no scientific information available on which to properly form an opinion for or against early neutering of male and female dogs or cats.

To stimulate discussion amongst the members of the profession, and on the basis of what seems to be a real lack of information on this subject, two approaches may be suggested in this matter:

1) The CVMA cannot recommend the early neutering of pets until such time as there is evidence through research to indicate otherwise. To stimulate research, funds should be made available through the Canadian Veterinary Research Trust Fund. Part of the funding should also be supported by the humane societies that initiated the discussion. Research could be allotted in the form of contract to veterinary colleges or research centers.

2) The CVMA can maintain its present position, i.e. make no firm statements for or against early neutering. However, it would seem unwise to depart from the traditional practice of spaying and neutering not before five to six months, when there is no research evidence to support an earlier age.

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TABLE I
SUMMARY OF OPINIONS OF RESPONDENTS

Reference	Institution	Effects on behavioral development	Effects on growth development	Anesthetic risks	Surgical risks	Do you recommend early spay/neuter?
RC Frost	Royal Veterinary College of London	Yes	Yes	Yes	Yes	No
CA Hjerpe	University of California, U.S.A.			Yes (if ether or pentobarb)		
A Tennyson	AVMA, U.S.A.			No position taken		
V Voith	University of Pennsylvania, U.S.A.	No				Yes
RW Kirk	Cornell University U.S.A.	Yes	Yes			No
JR Campbell	University of Edinburgh	No		No	No	No

Canadian institutions (Guelph, St. Hyacinthe, Saskatoon) offered either no opinion or did not respond