Surveillance of Wild Birds for Avian Influenza Virus

Technical Appendix

Source References

The articles reporting avian influenza surveillance in wild birds included in this review were obtained by searching for [influenza OR ortho*] AND [virus*] AND [surve* OR monitor* OR samp*] AND [wild* OR free-living OR “free living” OR feral OR migratory OR resident] AND [avian OR bird* OR waterfowl] on both Pubmed and Web of Knowledge on March 18, 2010. All studies were initiated between 1961 and 2007. We refined our list by including only peer-reviewed articles, and by excluding studies on captive individuals, domesticated species, or duplicate reports from the same study, resulting in the following 191 articles:


Paramyxovirus Isolation from Migratory Waterfowl and Shorebirds in San-In District of Western 


Birds in Eastern Europe, the Middle East, and Africa: Preliminary Results from an Ongoing 

Ghersi BM, Blazes D, Icochea E, Gonzalez RI, Kochel T, Tinoco Y, et al. Avian Influenza in wild birds 

Gilbert M. Disease Surveillance: Avian Influenza in Migratory Birds in Mongolia - Results of Extensive 


Globig A, Starick E, Werner O. Isolation of avian influenza from migratory waterfowl in Germany. 
Results of a two year study [in German]. Berliner Und Munchener Tierarztliche Wochenschrift. 

2007;51:382–6.

Graham DA, German A, Abernethy D, McCullough SJ, Manvell RJ, Alexander DJ. Isolation of ortho-
and paramyxoviruses from wild birds in Northern Ireland during the 1997 Newcastle disease 


viruses, Borrelia garinii, Mycobacterium avium, and Mycobacterium avium subsp 

Gronesova P, Kabat P, Trnka A, Betakova T. Using nested RT-PCR analyses to determine the prevalence 
of avian influenza viruses in passerines in western Slovakia, during summer 2007. Scandinavian 


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Sharp GB, Kawaoka Y, Wright SM, Turner B, Hinshaw V, Webster RG. Wild ducks are the reservoir for only a limited number of influenza A subtypes. Epidemiology and Infection. 1993;110:161–76.


Estimating Minimum Detectable Prevalence

To determine probability of detecting at least one infected individual, let $p$ be the prevalence of infection in a very large population (in which infected individuals are homogenously distributed). A randomly chosen individual from this population therefore has a probability of $p$ of being infected, but also a probability equal to $(1-p)$ of not being infected. If we sample $n$ individuals from this population at random, the probability that none of them are infected is $(1-p)^n$. Thus the probability of finding at least one infected individual ($P_{x>0}$) is then:

$$P_{x>0} = 1 - (1 - p)^n$$

Rearranging equation 1, we can calculate how many individuals to sample ($n$) to be ($P_{x>0}$) confident of detecting at least one infected individual when prevalence is above some pre-defined threshold ($p_{max}$):

$$n = \frac{\log(1-P_{x>0})}{\log(1-p_{max})}$$

While prevalence is rarely known before initiating a survey, a conservative limit of detection should be used; a nominal prevalence of 0.5% (i.e. $n=597$) has been suggested, indicating that at least 600 samples are required to achieve 95% confidence of disease freedom.

The maximum prevalence ($p_{max}$) of infection that could have been in the population is also calculable if all $n$ individuals were negative:

$$p_{max} = 1 - (1 - P_{x>0})^{\frac{1}{n}}$$

For example, if 300 individual birds were tested but no infection was detected, the study can be 95% confident that prevalence is less than 1%.