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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 sampl*] 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:

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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:

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

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}):

$$n = \frac{\log(1-P_{x>0})}{\log(1-p_{max})} \qquad (2)$$

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:

$$p_{max} = 1 - (1-P_{x>0})^{\frac{1}{n}} \qquad (3)$$

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%.