An Evaluation of Active Surveillance Testing Protocol Options for Early Marketing during an Outbreak of Highly Pathogenic Avian Influenza

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Background

- Pre-movement active surveillance is required for moving birds to processing within or outside of a 10km highly pathogenic avian influenza (HPAI) Control Area

- Current pre-movement guidelines include a period of heightened biosecurity implemented prior to the start of load-out
  - Termed a pre-movement isolation period (PMIP)
  - Example of heightened biosecurity is no off-farm disposal of mortality or garbage during the PMIP

Baseline Active Surveillance Protocol + PMIP

- 1 pool of 11 swabs collected within 24 and within 48 hours before the start of load-out (2 pools total) tested by rRT-PCR
- PMIP length of 5 days for broilers and 8 days for turkeys
- Surveillance protocol in combination with ideal PMIP should reach target of 95% detection in HPAI infected houses prior to load-out

Early Marketing

- Defined here as a producer sending a flock to processing prior to its scheduled date
  - Benefits: reduces the number of susceptible premises in an area and thus the potential for outbreak spread
  - Potential Consequences: increased risk of HPAI spread during live bird transport
- Producers who might want to move within the first few days in a newly established or expanded HPAI Control Area
  - A full duration PMIP can’t be completed (takes 5 or 8 days)
  - Alternative testing protocols may help mitigate the increased likelihood of moving an infected, undetected flock

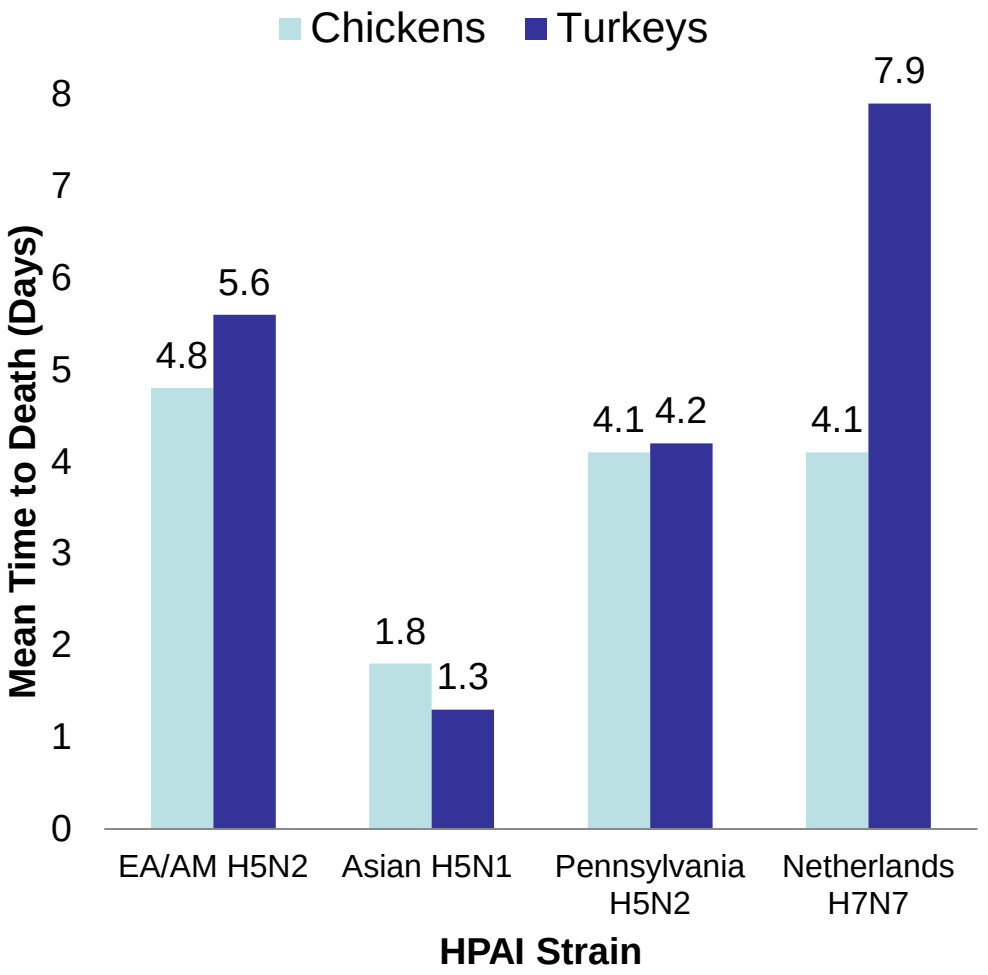
Evaluation of Testing Protocols

- Simulation models used to predict:
  - Probability of detection prior to load-out
  - Mean number of infectious birds at the time of load-out in undetected houses
- Simulations run for 6000 iterations for Eurasian/American HPAI H5N2 strain

Simulation Parameter Estimates		
	Broiler Estimates	Turkey Estimates
Mean Flock Size	24,257 birds	15,188 birds
Mean Latent Period Length	0.64 days	1.41 days
Mean Infectious Period Length	4.17 days	4.20 days

Mean Time to Death Comparison

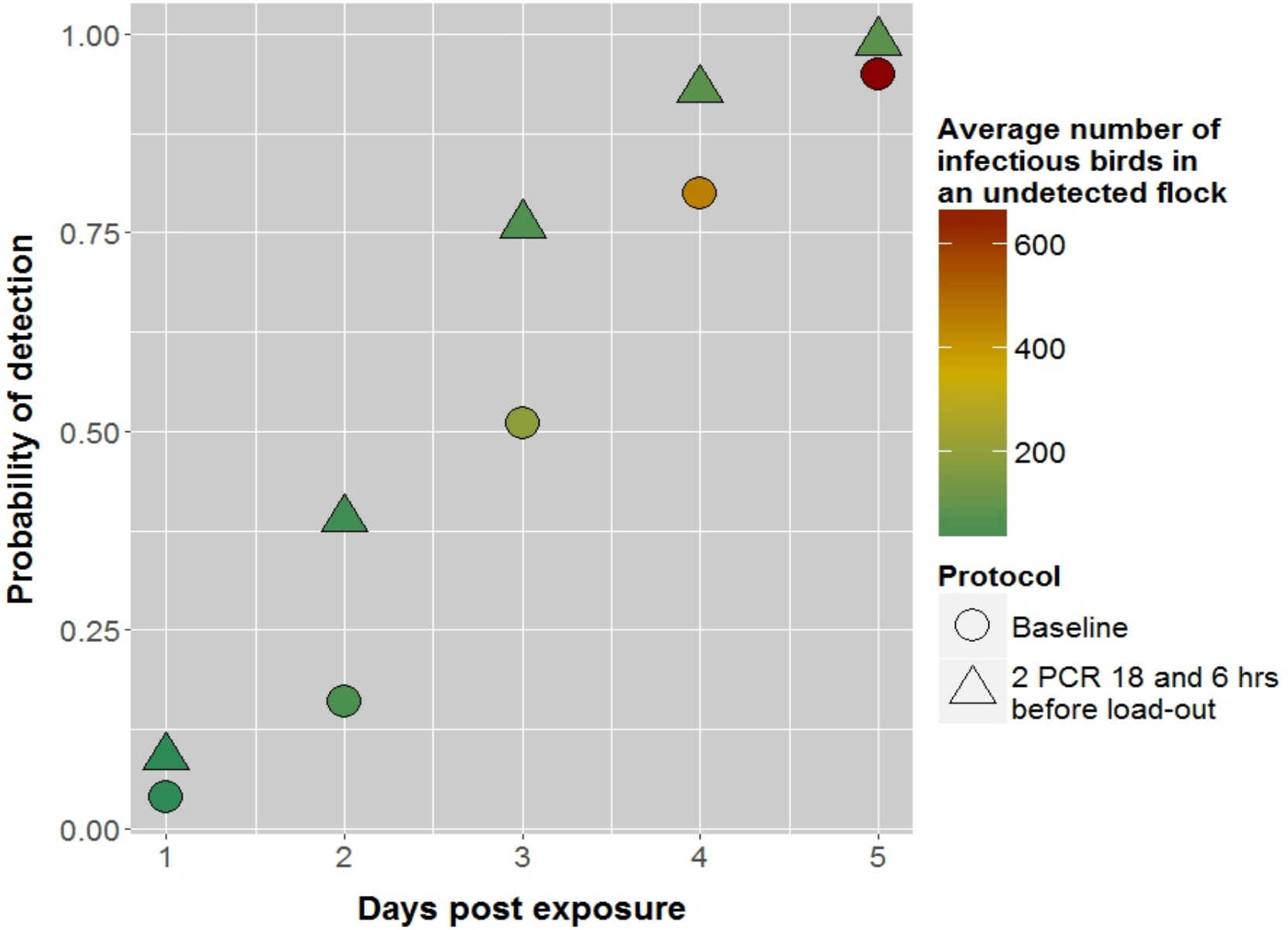
- Longer mean time to death leads to longer time to detection
  - HPAI in turkeys generally more difficult to detect than in broilers
  - EA/AM HPAI H5N2 has relatively long mean time to death



Broiler Testing Protocol Results

Probability of Detection					
rRT-PCR Testing Protocol	Number of days prior to the day of load-out when exposure to HPAI occurs				
	1	2	3	4	5
Baseline: 1 pooled sample of 11 swabs taken within 24 and within 48 hours before load-out (2 pools total)	0.04	0.16	0.51	0.80	0.95
All daily mortality sampled using pools of 11 swabs within 24 and within 48 hours before load-out (2 pools or more total)	0.05	0.21	0.61	0.88	0.97
Baseline + 1 additional pooled sample of 11 swabs taken within 24 hours before load-out (3 pools total)	0.04	0.19	0.58	0.86	0.96
2 pooled samples of 11 swabs taken at 18 and at 6 hours before load-out (4 pools total)	0.09	0.39	0.76	0.93	0.99

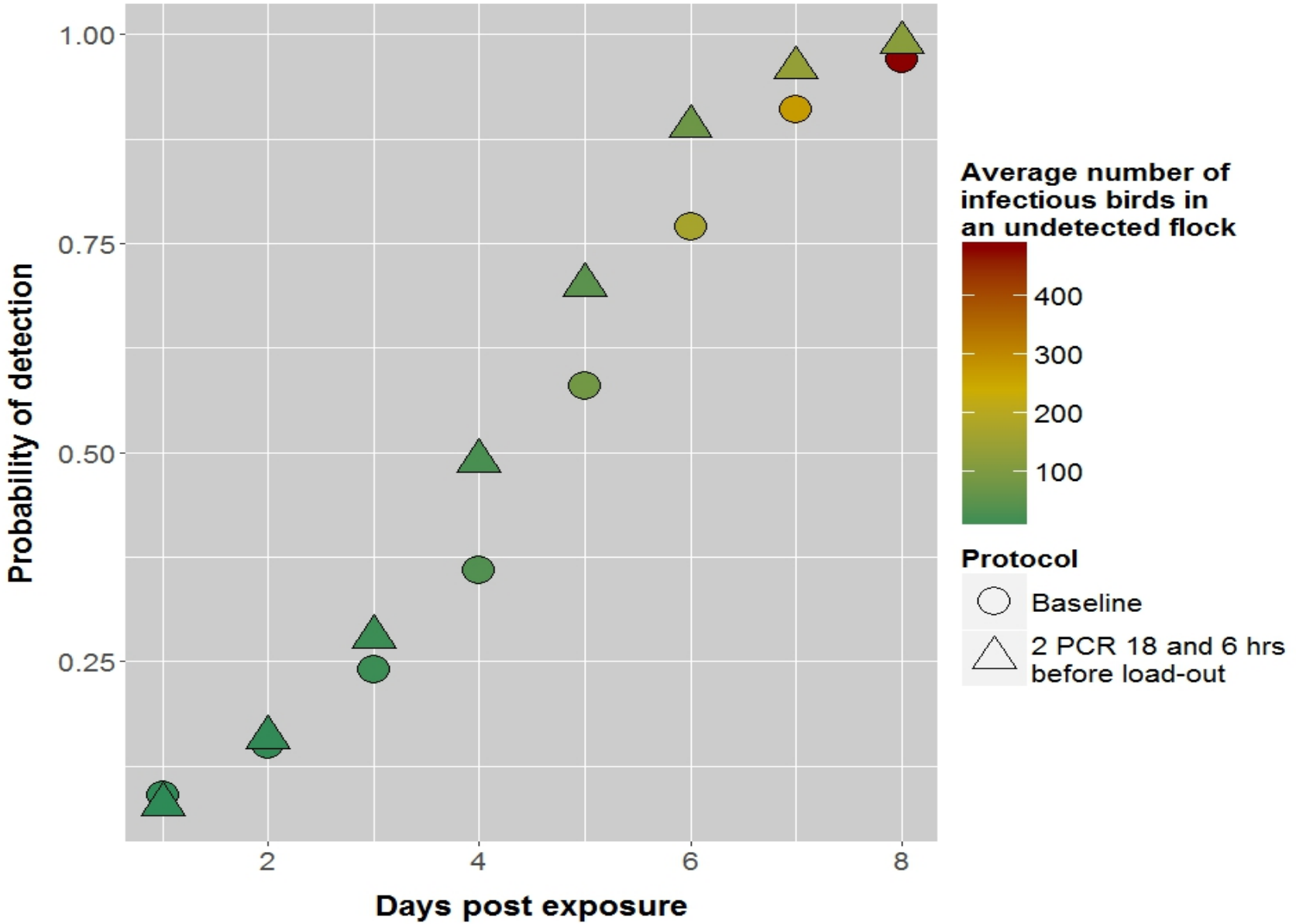
Broiler Protocol Comparison



Turkey Testing Protocol Results

Probability of Detection								
rRT-PCR Testing Protocol	Number of days prior to the day of load-out when exposure to HPAI occurs							
	1	2	3	4	5	6	7	8
Baseline: 1 pooled sample of 11 swabs taken within 24 and within 48 hours before load-out (2 pools total)	0.09	0.15	0.24	0.36	0.58	0.77	0.91	0.97
All daily mortality sampled using pools of 11 swabs within 24 and within 48 hours before load-out (2 pools or more total)	0.09	0.15	0.23	0.40	0.64	0.83	0.95	0.99
Baseline + 1 additional pooled sample of 11 swabs taken within 24 hours before load-out (3 pools total)	0.09	0.14	0.23	0.38	0.61	0.81	0.94	0.98
2 pooled samples of 11 swabs taken at 18 and at 6 hours before load-out (4 pools total)	0.08	0.16	0.28	0.49	0.70	0.89	0.96	0.99

Turkey Protocol Comparison



Turkey Drinker Biofilm Sampling: Preliminary Results

- Biofilm swabbed from turkey drinkers tested by rRT-PCR
  - Sampling not dependent on mortality, draws from a greater proportion of the population
- Simulation parameters used (and may need further refinement):
  - A turkey takes 60 drinks per day
  - Biofilm becomes positive once at least 5 drinks have been taken by an infectious bird
  - There are 150 birds per drinker

Turkey Drinker Biofilm Sampling: Preliminary Results

Probability of Detection							
rRT-PCR Testing Protocol	Number of days prior to the day of load-out when exposure to HPAI occurs						
	1	2	3	4	5	6	7
Baseline: 1 pooled sample of 11 swabs taken within 24 and within 48 hours before load-out (2 pools total)	0.09	0.15	0.24	0.36	0.58	0.77	0.91
Baseline + 2 pooled samples of swabs from 4 drinkers each taken within 24 hours before load-out (4 pools total)	0.11	0.32	0.59	0.82	0.94	0.99	>1.00

Conclusion

- Additional and/or later sampling predicted to increase the probability of detection and decrease the number of infectious birds in undetected flocks at the start of load-out compared to baseline
  - Two alternative testing protocols achieve 95% detection 1 day earlier after exposure in turkeys (no change in broilers)
  - Ability to perform the alternative testing protocols may be limited by lab capacity and distance from lab
- Early marketing decision requires weighing the associated risks and benefits
  - When implementing a full PMIP is not possible during the first few days of an outbreak, producers might consider additional risk mitigation strategies (e.g. routing) with increased/later testing

Acknowledgments

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