

Optimizing early detection of avian influenza H7N9 in live bird markets in Vietnam

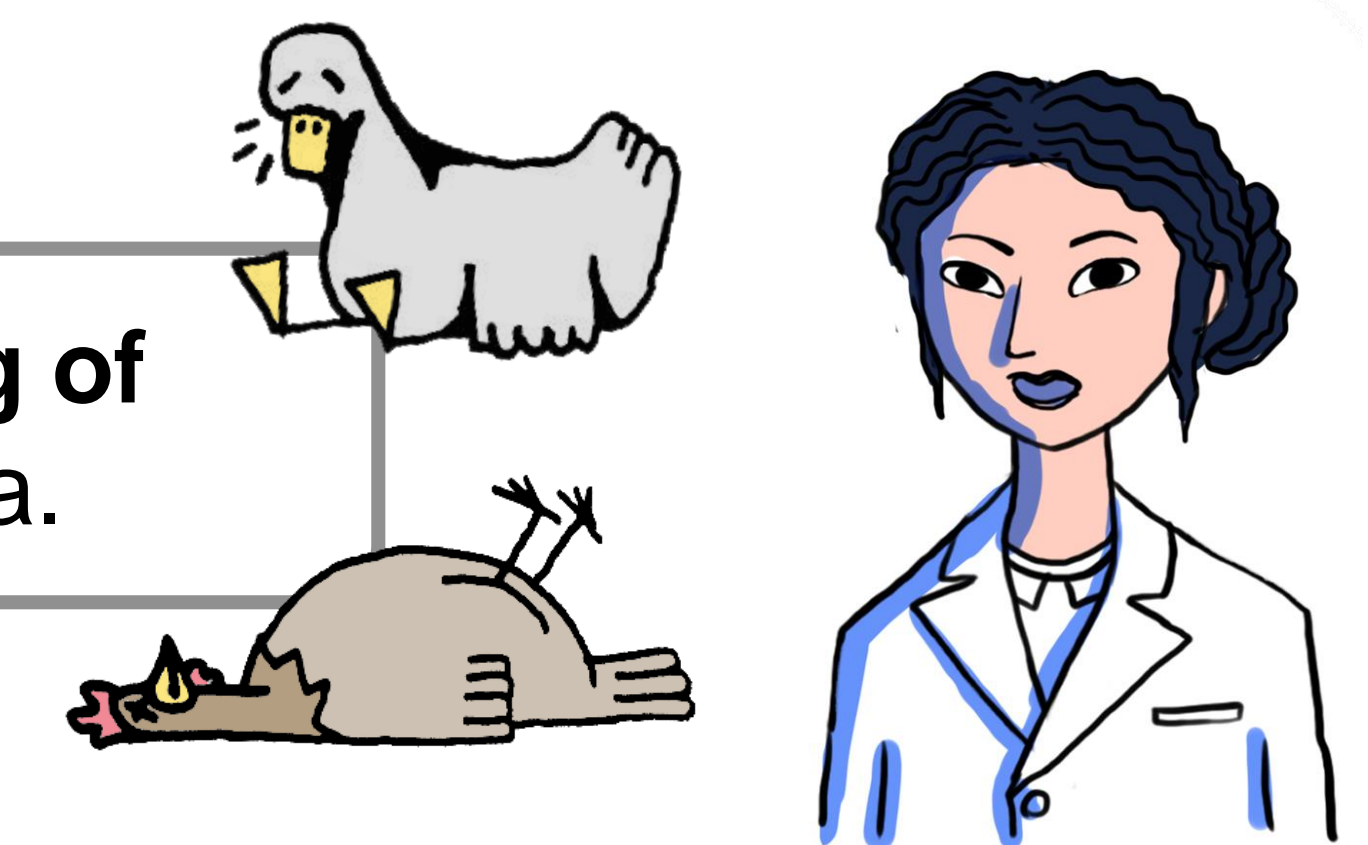
C. GUINAT¹, D. TAGO², P. PADUNGTOD², T. NGUYEN THI THANH², K. INUI², P. THANH LONG³, O. KIM THUY⁴, M. PAUL¹, T. VERGNE¹

BACKGROUND

Lately, the novel avian-origin H7N9 virus has emerged in Eastern China, causing severe respiratory disease and fatalities in humans. In China, and in other South-East Asia countries, **live bird markets (LBMs) have proven to act as a potential reservoir of H7N9 infection for poultry and humans** and are therefore targeted for implementing surveillance strategies. However, most of the surveillance programs are designed without considering the profile specificities of each LBM in the South-East Asian region, preventing timely and effective detection, and **thus more adapted surveillance strategies for H7N9 is imperative.**

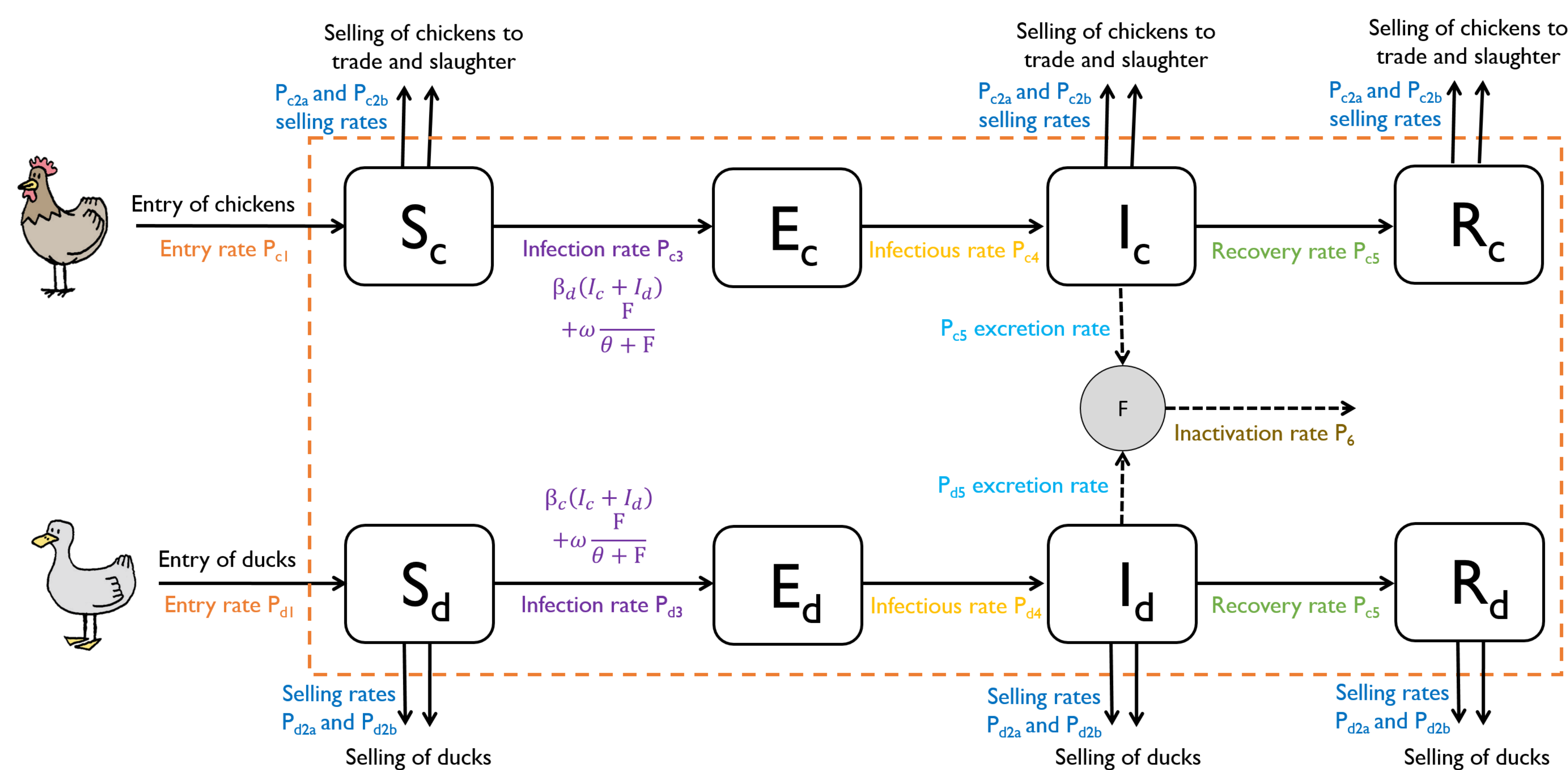
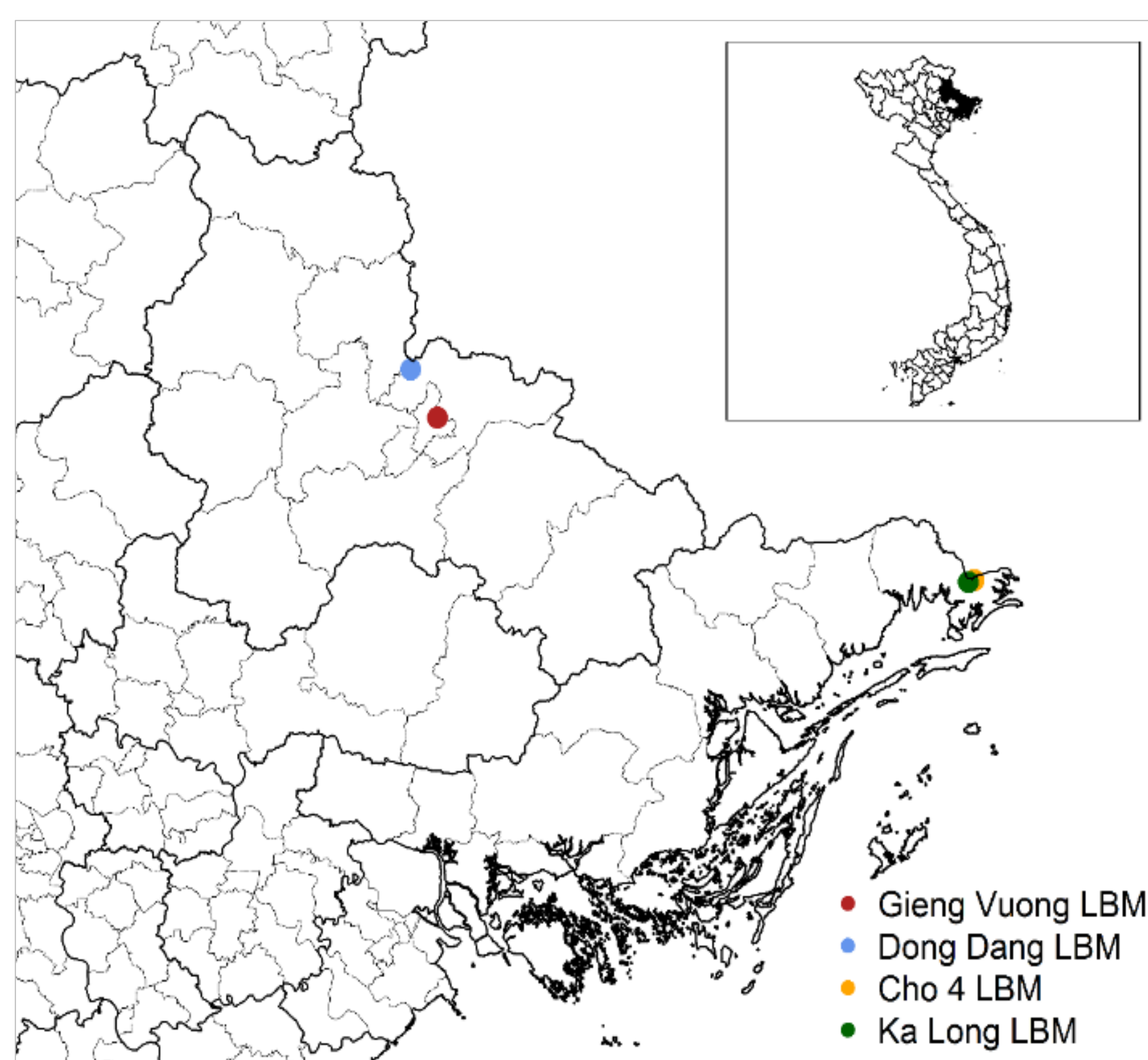
PURPOSE

This study therefore aims at **optimizing surveillance strategies required for early warning of H7N9 virus introduction**, given the specificity of different types of LBMs in South East Asia.



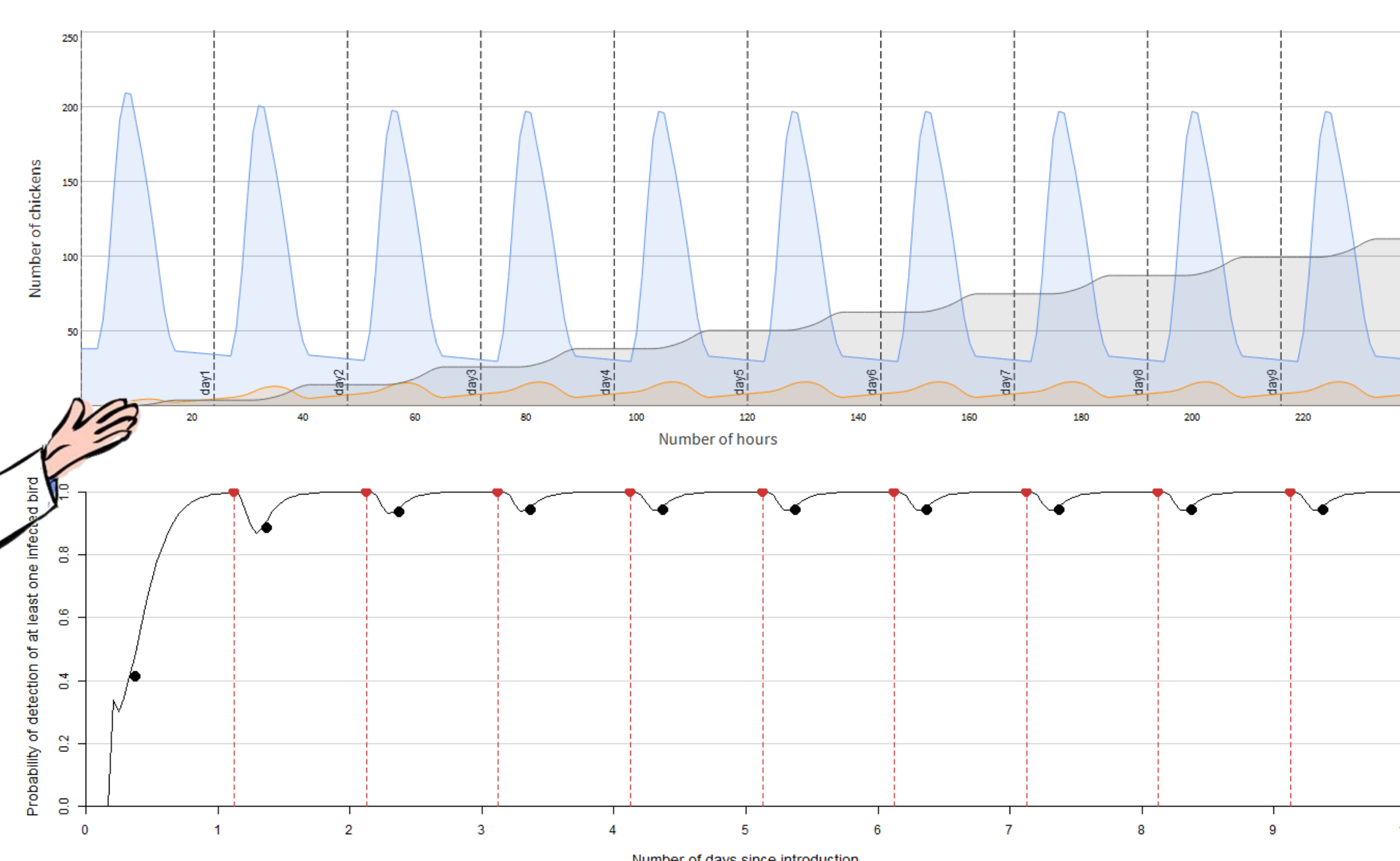
METHODS

We developed and calibrated a **deterministic compartmental transmission model for H7N9** to fit four different LBMs in North Vietnam at the border of China identified as at high risk of infection **to assess the effectiveness of different scenarios of surveillance strategies.**



RESULTS

The model allows simulating the dynamics of HPAI H7N9 within the poultry population at the LBM. For a given LBM, outcomes indicate that the LBM should be sampled at **3am to have the highest probabilities of detecting at least one infected bird.**



Sampling frequency	Likely detection delay since virus introduction (day)	Estimated number of infected birds that have left the LBM at the time of sampling	Estimated costs per week during peace time (\$)	Estimated costs per week since virus introduction (\$)
Traditional lab-based surveillance strategy				
Twice a week	5	123	3,781	10,876
Once a week	8	169	1,620	16,314
Current Pen-side PCR surveillance strategy				
Twice a week	2	32	2,083	4,598
Once a week	5	77	892	9,196
Optimized Pen-side PCR surveillance strategy				
Twice a week	1	5	2,083	3,065
Once a week	4	47	892	7,663

Under plausible parameter scenarios, results suggest that the **optimized pen-side PCR surveillance strategy would be the most efficient strategy** to reduce the number of infected birds that have left the LBM at the time of sampling and the surveillance costs compared to other surveillance strategies.

CONCLUSION

The findings presented here make a contribution to the **knowledge base required for the design of surveillance programmes** aimed at limiting H7N9 introduction and spread in poultry and human population in South East Asia. Model and outputs will be made publicly available with a graphical user interface for the stakeholders and decision makers.