



# The ENIGMA HPAI model – forecasting highly pathogenic avian influenza in Europe



Lene J. Kjær<sup>1</sup>, Anette E. Boklund<sup>1</sup>, Lars E. Larsen<sup>1</sup>, Charlotte K. Hjulsager<sup>2</sup>, Michael P. Ward<sup>3</sup> & Carsten T. Kirkeby<sup>1</sup>

The ENIGMA HPAI model is an endemic/epidemic highly pathogenic avian influenza (HPAI) H5 forecasting model, incorporating within-country transmission, between-country transmission, short-distance transmission (from directly neighboring countries), and long-distance transmission. The model and its forecast publicly available at [www.enigmahpai.org](http://www.enigmahpai.org)

The aim of the ENIGMA HPAI model is to enhance global preparedness for avian influenza, enabling countries in Europe to inform decision-makers and implement preventive measures based on the regularly updated data from WOA-WAHIS.

The underlying model has been published in Scientific Reports: Kjær et al. (2023), Sci Rep 13, 15396 (2023).

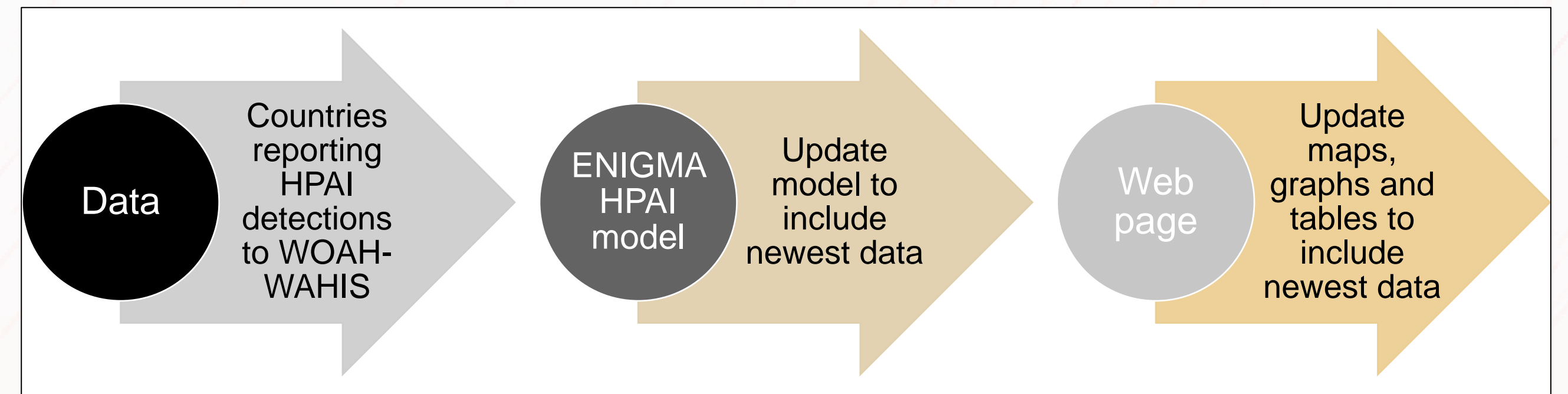
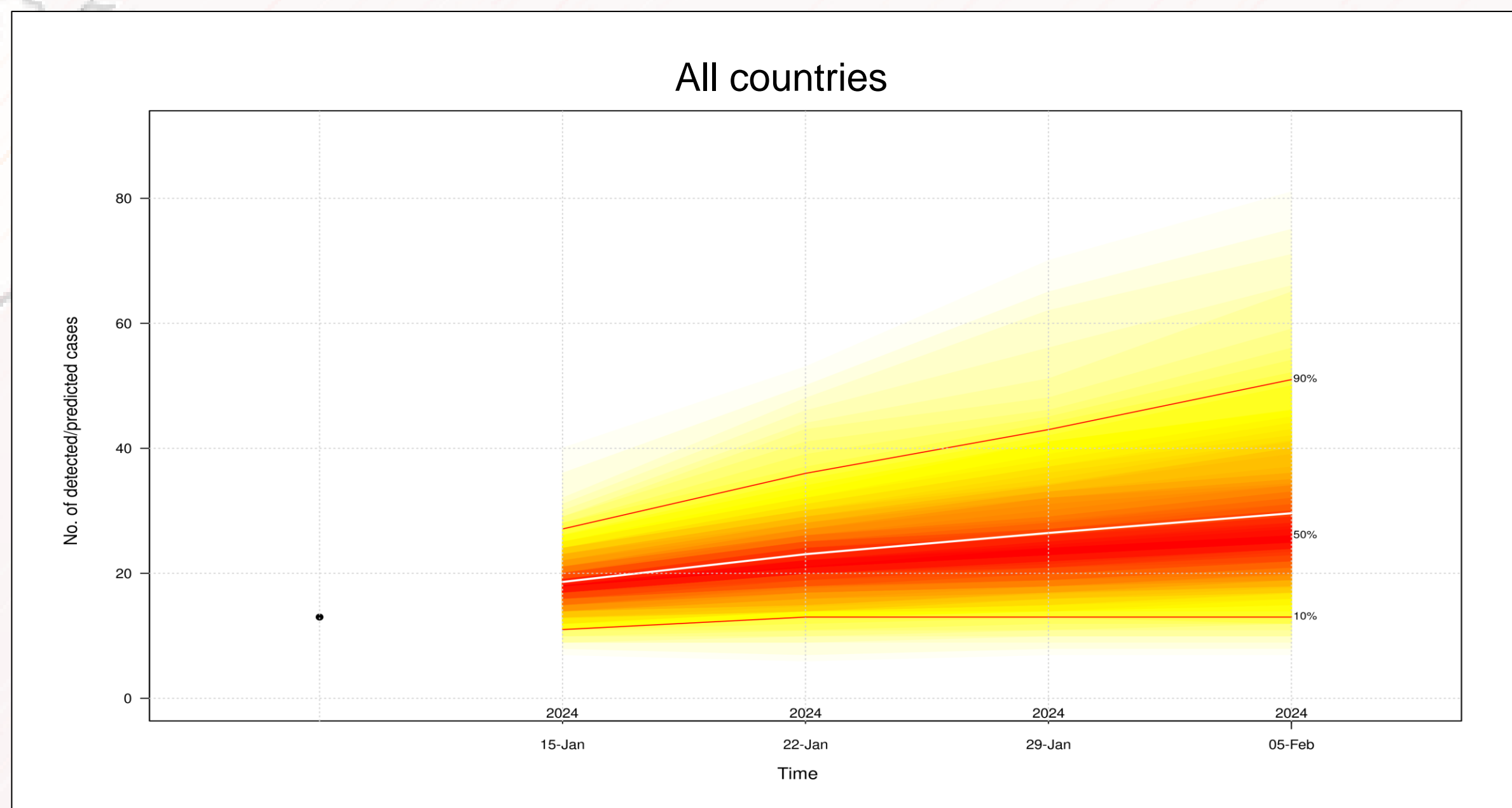
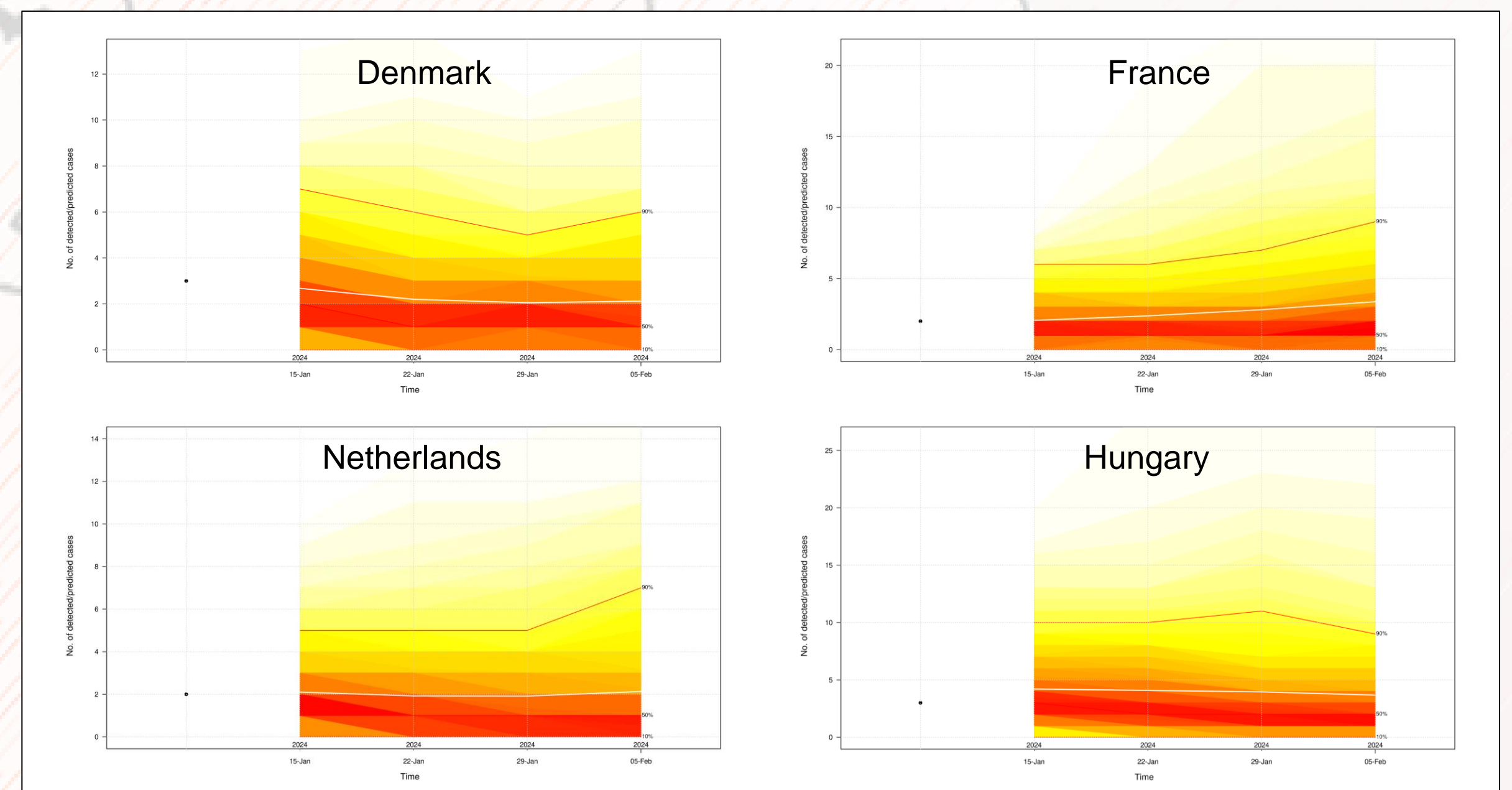


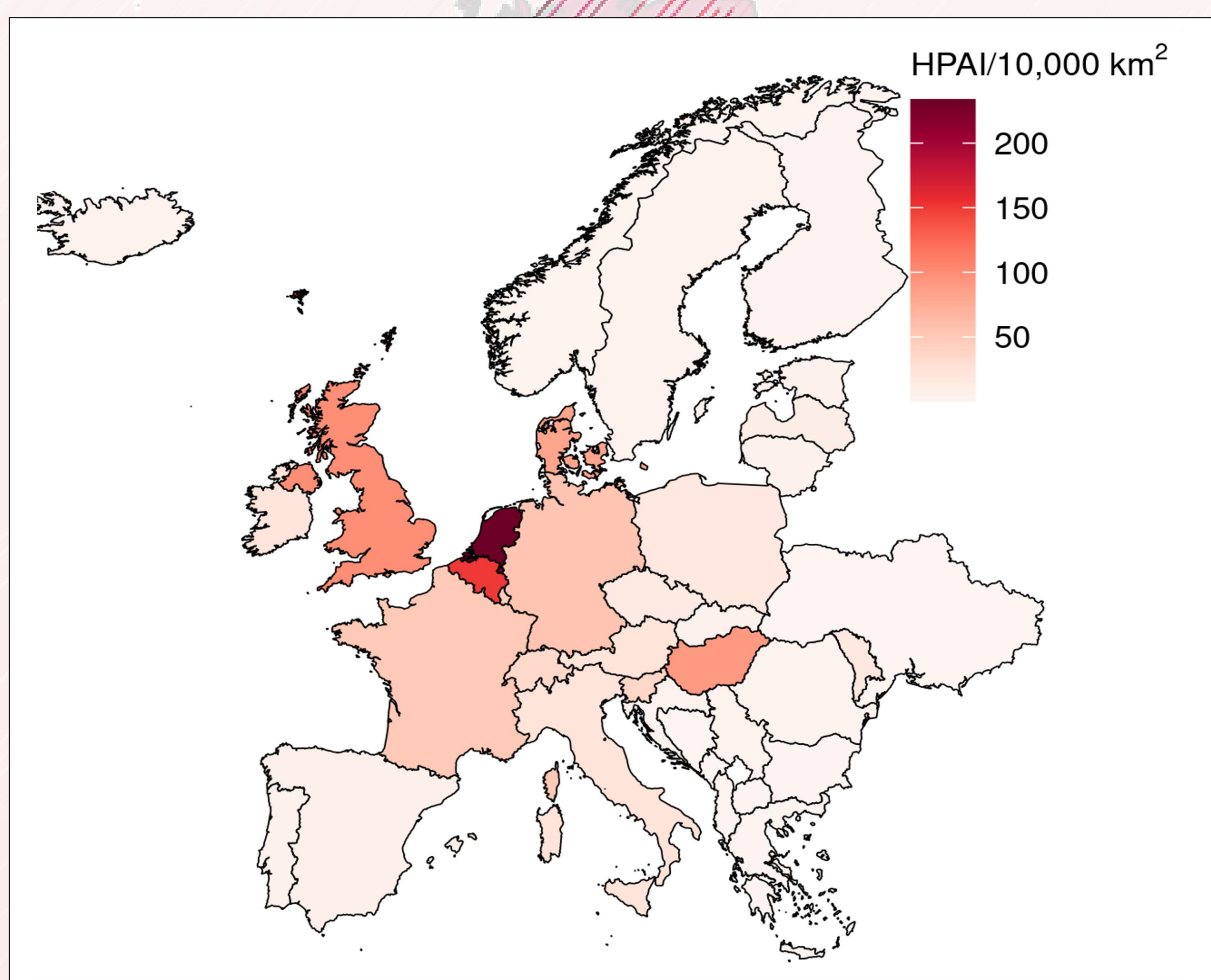
Diagram showing the origin of data and how it is used to create the ENIGMA HPAI model.



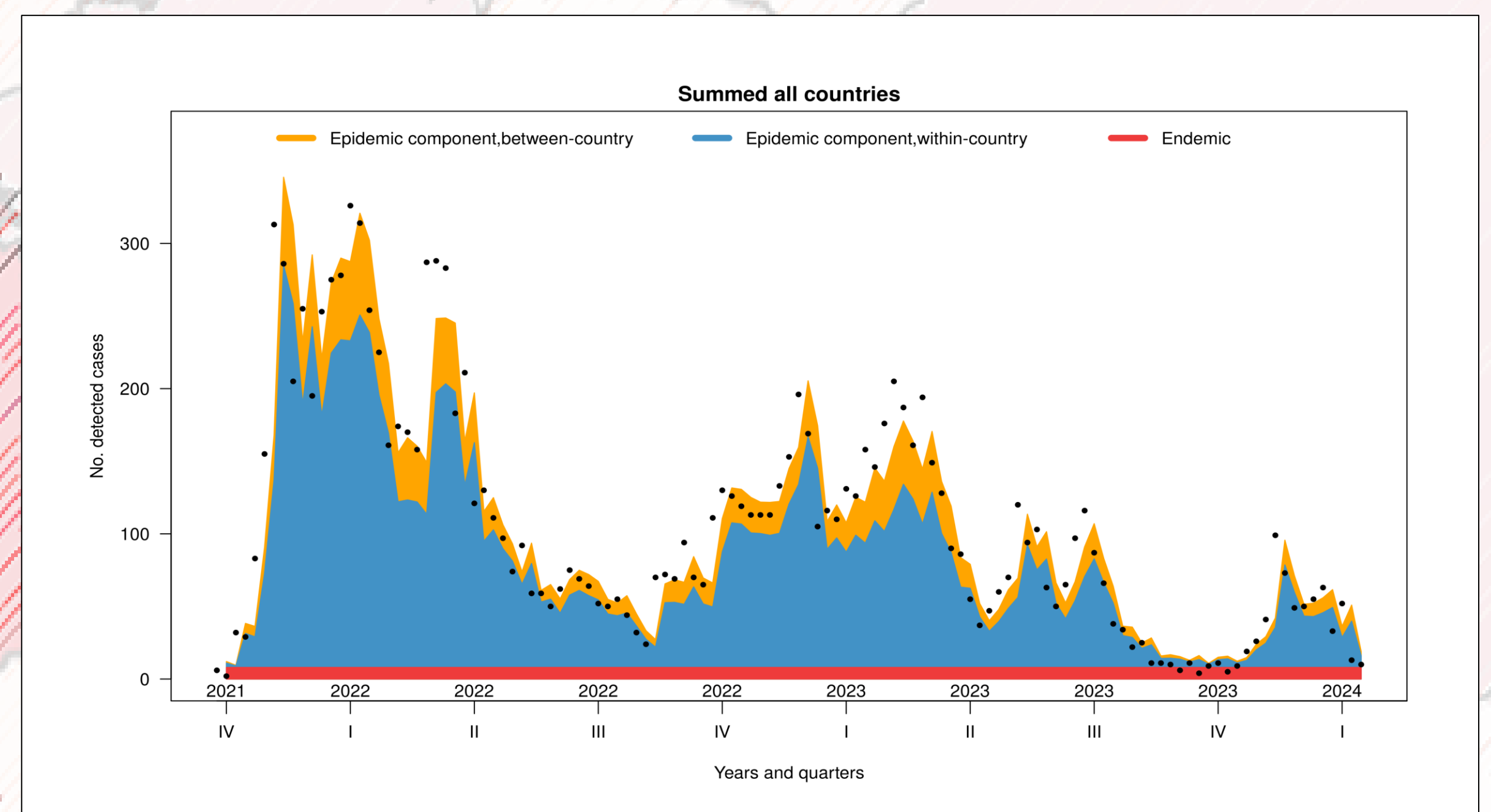
The ENIGMA HPAI model forecasts 4-week simulation-based HPAI forecast with 10%, 50%, and 90% quantiles based on 500 simulations. The mean is shown as white line, and the black dot signifies detections in the first week of 2024.



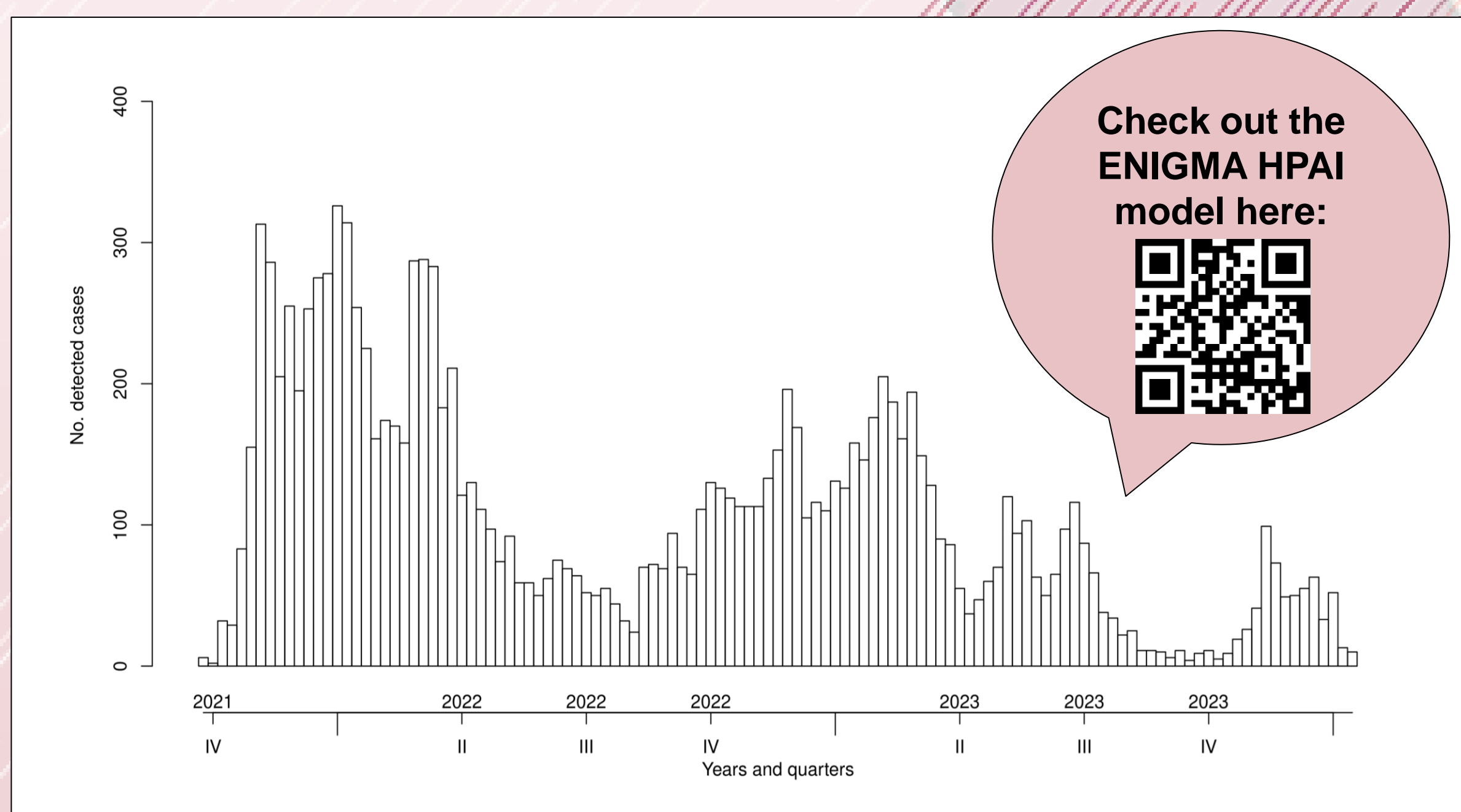
You can also find forecasts for individual countries, here for Denmark, France, The Netherlands, and Hungary.



At [www.enigmahpai.org](http://www.enigmahpai.org) you can also find maps of HPAI detections reported to WOA-WAHIS within the selected time period.



This plot shows overall model fit per week from 2021-2024 and how the model divides predictions into endemic- and epidemic components.



Check out the ENIGMA HPAI model here:

At [www.enigmahpai.org](http://www.enigmahpai.org), you can choose which time period, you are interested in, and the model will make several plots based on the time period selection.

Table showing HPAI detections per country ordered from highest to lowest. Search: [input].

Country	#HPAI detections
1 France	2754
2 United Kingdom	2423
3 Germany	1948
4 Netherlands	864
5 Hungary	841

Download csv

Showing 1 to 5 of 37 entries Previous 1 2 3 4 Next

Tables of HPAI detections reported to WOA-WAHIS within a selected time period can be downloaded as a csv-file.

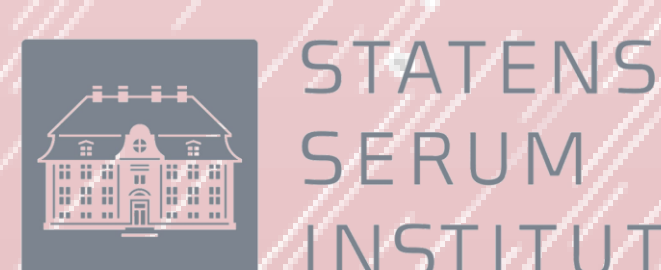
All maps, graphs and tables on the home page can be downloaded for further use.

The ENIGMA project is based in the Avian Influenza Epidemiology Subgroup at the University of Copenhagen and is part of the Danish Veterinary Contingency Consortium (DKVET) funded by the Danish Food and Veterinary Administration.

<sup>1</sup>Department of Veterinary and Animal Sciences, University of Copenhagen, Frederiksberg, Denmark

<sup>2</sup>Statens Serum Institut, Copenhagen, Denmark

<sup>3</sup>Sydney School of Veterinary Science, University of Sydney, Camden NSW, Australia



Lene Jung Kjær, Associate Professor  
Section for Animal Welfare and Disease Control  
Department of Veterinary and Animal Sciences  
University of Copenhagen  
Email: [lenju@sund.ku.dk](mailto:lenju@sund.ku.dk)

