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Annika M. van Roon, Aurélien Madouasse, Nils Toft, Inge M. G. A. Santman-Berends, Jörn M Gethmann, Jude Eze, Roger W Humphry, David A. Graham, Maria Guelbenzu-Gonzalo, Mirjam Nielen, et al.

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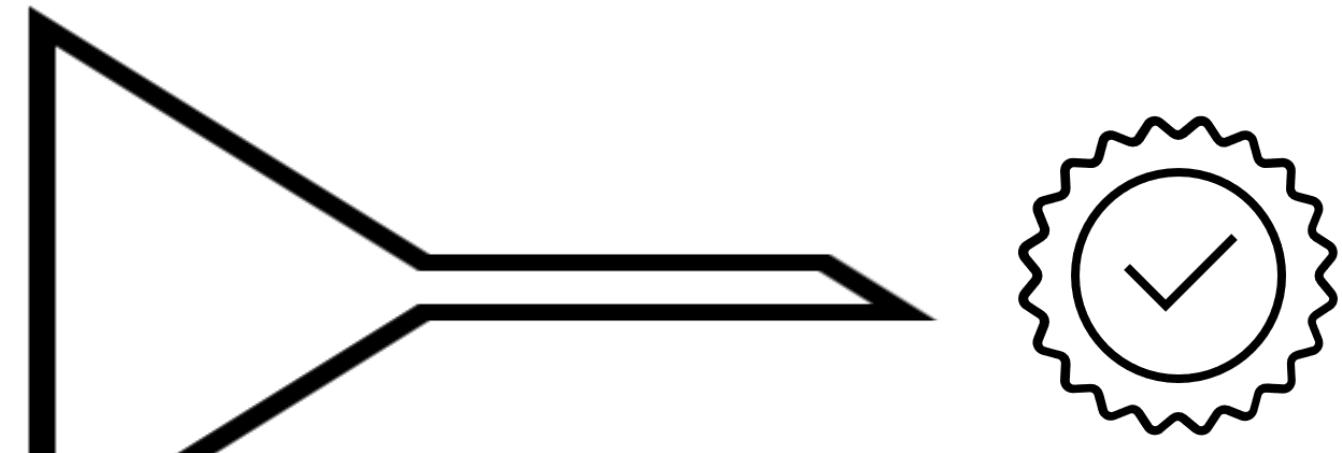
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Output-based assessment of herd-level freedom from BVDV

A.M. van Roon¹, A. Madouasse², N. Toft³, I.M.G.A. Santman-Berends⁴, J. Gethmann⁵, J. Eze⁶, R.W. Humphry⁶, D. Graham⁷, M. Guelbenzu-Gonzalo⁷, M. Nielen¹, S.J. More⁸, M. Mercat², C. Fourichon², C. Sauter-Louis⁵, J. Frössling^{9,10}, E., Ågren⁹, G.J. Gunn⁶, M.K. Henry⁶, and G. van Schaik^{1,4}

Background

Output-based assessment of heterogeneous disease control programmes



Uniform output: Freedom from disease

Methods

Longitudinal test data on herd-month level in 2019

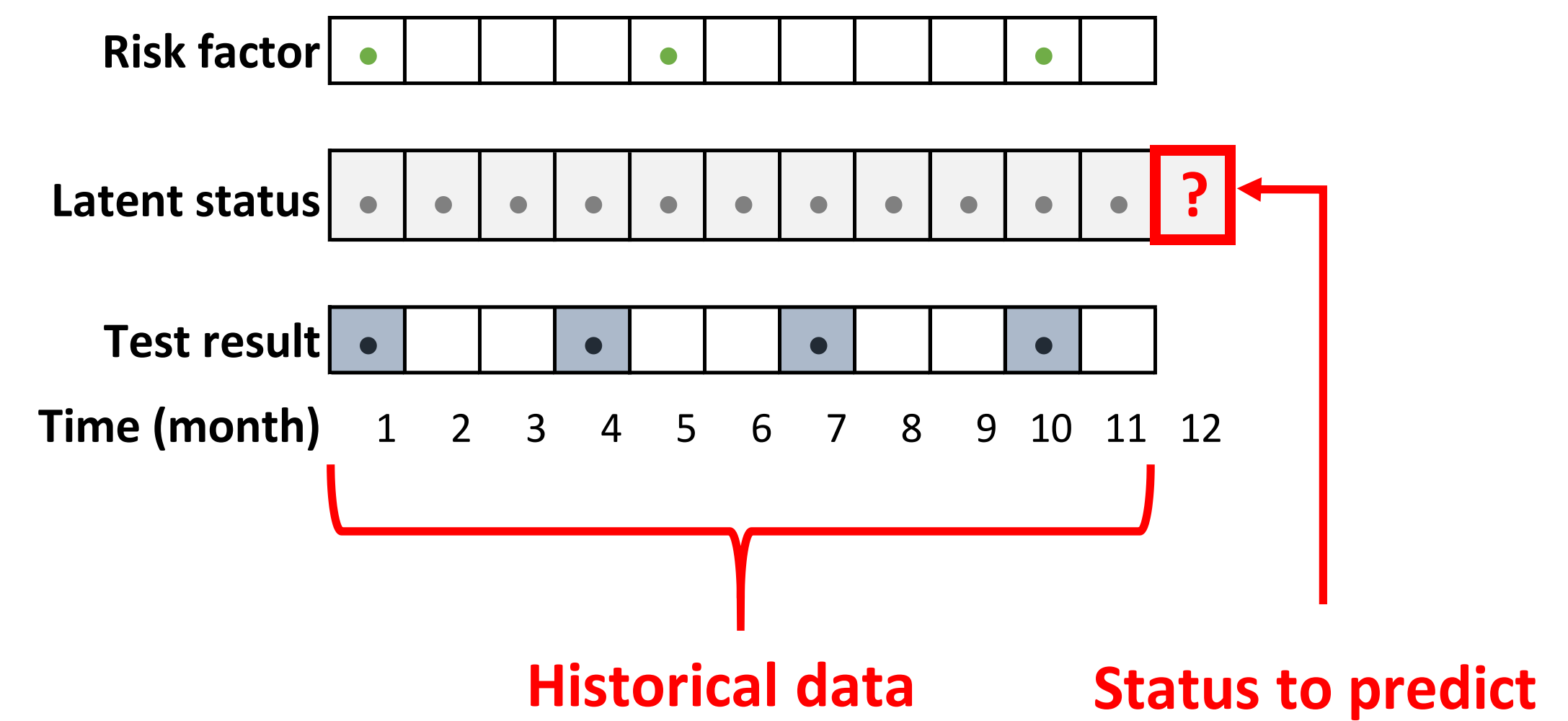
| Herd(s)-Type | NL | | DE (Paderborn) | | IE | | SCO | |
|--------------------------|--------|-------------|----------------|---------|-------|-------|-------|------|
| | Dairy | Combination | Dairy | Beef | Dairy | Beef | Dairy | Beef |
| Number | 1,642 | 361 | 16,097 | 49,685 | 559 | 1,796 | | |
| ≥ 1 positive test result | 161 | 11 | 231 | 267 | 64 | 77 | | |
| Total test months | 12,566 | 2,475 | 78,884 | 180,604 | 3,724 | 6,413 | | |
| Positive test months | 270 | 25 | 316 | 340 | 111 | 117 | | |
| Free according to CP | 486 | 319 | 14,743 | 45,989 | 332 | 1,713 | | |

Aim

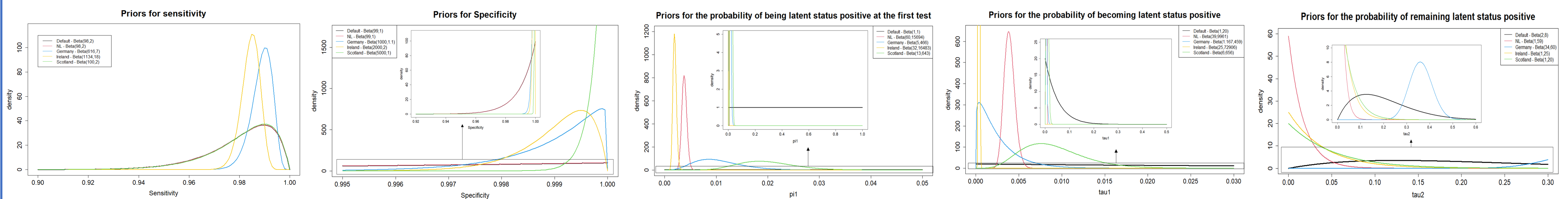
- Estimating the probability of freedom from Bovine Viral Diarrhea Virus in control programmes based on ear notch sampling in different study regions.
- Evaluation of the sensitivity of the posterior estimates (e.g. predicted probability of freedom from infection) to the prior distributions.

STOC free MODEL

- Hidden Markov model
- Freely available with default values for BVDV, that are adaptable to country specific values: *Madouasse A, et al. (2021)*



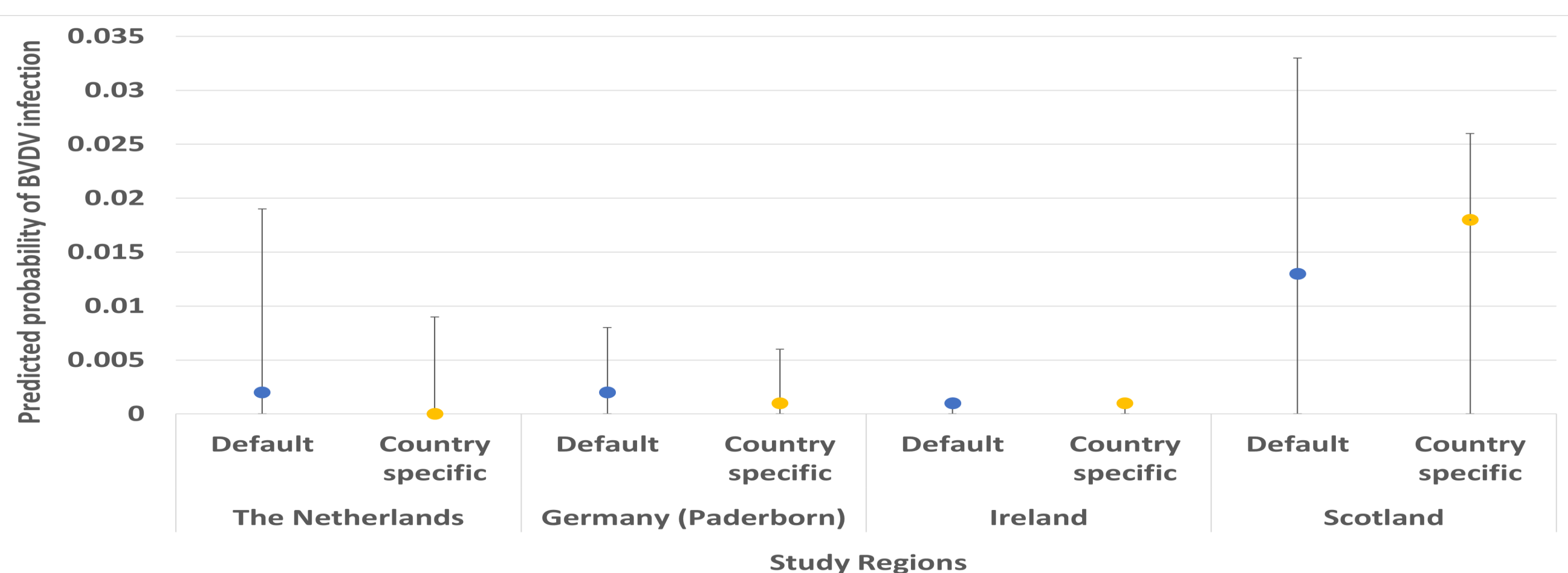
Prior input: default and country-specific beta distributions



Madouasse et al., 2021. A modelling framework for the prediction of the herd-level probability of infection from longitudinal data. bioRxiv, 2020.07.10.197426

Results

Results for dairy herds with a free status on 1 December 2019 according to the BVDV CP based on ear notch testing in each study region



Predicted probability of infection (median with 2.5% and 97.5% credibility interval)

- Probability of freedom: 0.98-1.00
- Herd-level test sensitivity: 89% - 98%
- Herd-level test specificity: >99%
- Probability of herd becoming positive (incidence): 0.001-0.015
- Probability of herd remaining positive: 0.372-0.624

Discussion

- High probability of freedom for all four regions, suggesting comparable effectiveness of BVDV CPs based on ear notch sampling
- A lower predicted probability of freedom can either be the result of positive tests or uncertainty due to missing test results i.e. no births
- Default priors can be used when no country-specific data are available
- Output-based modelling of BVDV is challenging due to (1) complexity of the infection e.g. time between infection and birth of PI(s), (2) CPs with tests aiming at detection of different latent statuses i.e. virus and antibodies, and (3) estimation of herd-level priors while CPs are based on animal-level testing.
- The STOC free model can be used to evaluate and improve disease CPs and to determine whether they comply with output-based regulations of the EU. The code is freely available at: <https://github.com/AurMad/STOCfree>



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