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# Risk-based testing of imported animals: A case study for bovine tuberculosis in the Netherlands

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## Introduction

In intra-EU trade, the health status of animals is warranted by issuing a health certificate after clinical inspection in the exporting country. This certificate cannot provide a 100%-guarantee of absence of disease, especially not for diseases with a long incubation period and no obvious clinical signs such as bovine tuberculosis (bTB).

The Netherlands is officially free from bTB since 1999. However, frequent reintroductions occurred in the past 15 years by importation of infected cattle originating from both bTB-infected and bTB-free EU member states.

Additional testing (AT) of the animals six weeks after importation with the skin test would enhance the probability of detecting an imported bTB infection in an early stage. In intra-EU trade, AT is only allowed when done randomly, i.e. no distinction is to be made between animals based on exporting country. Testing of all imported cattle would entail a high cost and results in many false-positive diagnostic test results. Therefore, it would be advantageous if AT could be risk-based, i.e., only those cattle are tested that are estimated to have a high probability of being infected.

## Objective

To evaluate the effectiveness of risk-based additional testing for bTB in cattle imported into the Netherlands.

## Material and methods

*Risk model*

A generic import risk model was built in Excel and @Risk:

- To simulate risk of bTB introduction into the Netherlands
- To optimize sampling strategy for risk-based additional testing (AT)
- To evaluate cost-effectiveness of AT of imported animals

*Input data*

- Intra-EU trade statistics (breeding cattle, production cattle and calves)
- bTB prevalence data for EU member states
- Test characteristics of skin test
- Economic parameters

*Basic scenarios*

- *Default*: imported cattle not tested for bTB
- *Test-8*: 8% of imported cattle tested for bTB, equally distributed over countries and cattle groups
- *Test-100*: all imported cattle tested for bTB

*Optimized scenarios*

In these scenarios, the percentage of imported cattle tested for each country-cattle group combination was optimized to:

- *OPT-Det*: maximize number of bTB-infected animals that is detected
- *OPT-Loss*: minimize economic loss of importation of bTB-infected cattle

under the constraint that ≤ 8% of all imported cattle is tested.

## Conclusions

- The Netherlands imports bTB-infected cattle each year, of which only a few have been detected in the past 15 years.
- Risk-based sampling greatly improves the effectiveness of additional testing (AT).
- The preferred sampling strategy depends on the purpose of AT.
- If the number of bTB-infected animals detected is maximized, 77% of all infected cattle can be detected by risk-based testing whereas only 6.9% is detected when tests are performed randomly.
- If the overall economic loss of importing bTB-infected cattle is minimized, economic loss is reduced with almost 90% if compared to no AT.
- To minimize overall economic loss, the focus of AT should be on breeding and production cattle, because detection of bTB-infected calves results in a net economic loss (cost of detection > expected gain of preventing an outbreak starting on a veal farm).
- The method applied could be used as a template for other diseases.

## Results

*Introduction risk of bTB for the Netherlands*

- The annual probability of bTB introduction is 1.
- Breeding cattle contribute 1.3%, production cattle 2.8%, and calves 95.9% to this probability.
- Ireland, UK, Germany, Italy, Belgium, and Poland contribute > 99% of all imported bTB-infected cattle.

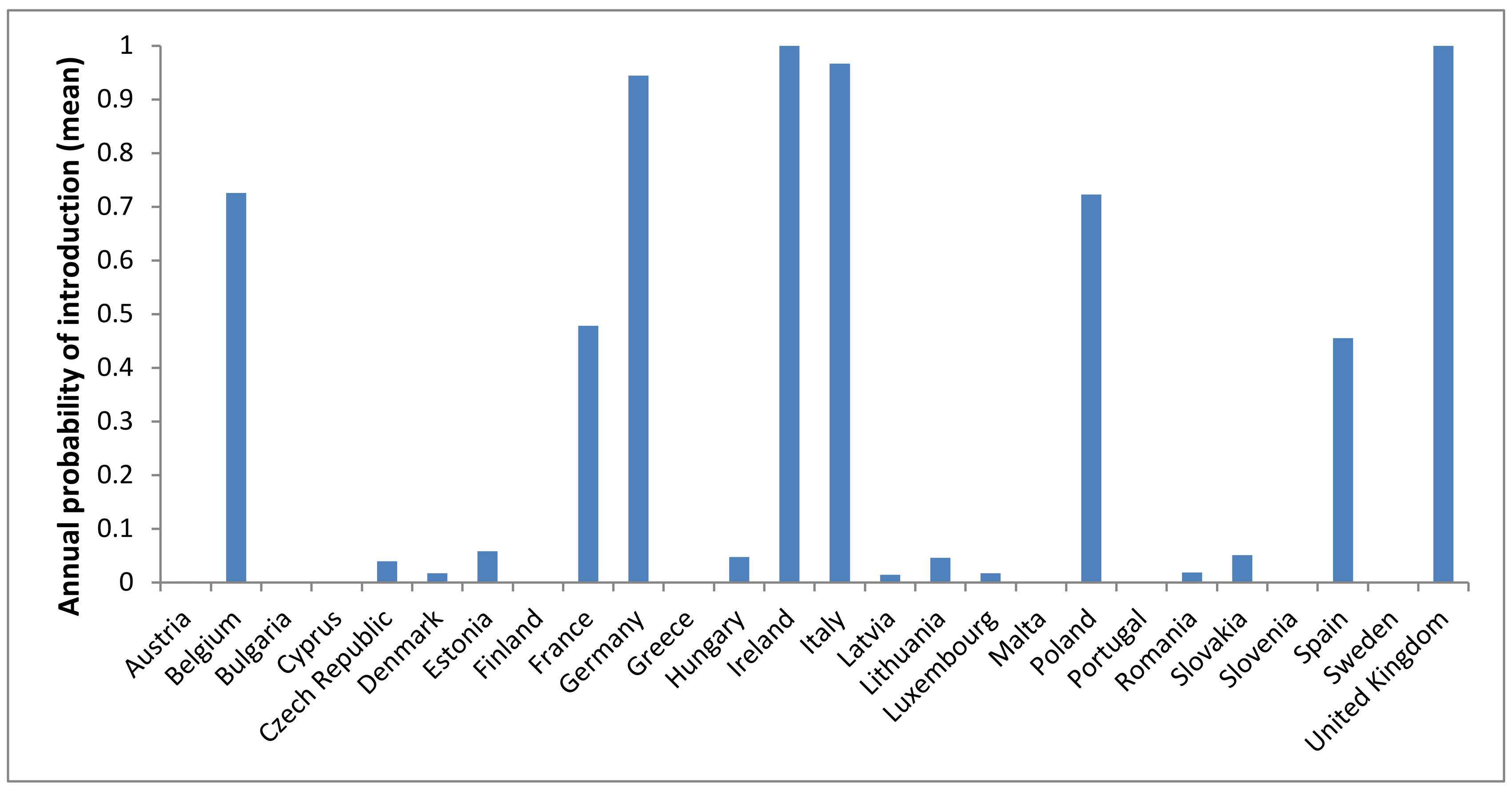


**Figure 1.** Annual probability of bTB introduction into the Netherlands

*Detection of bTB-infected cattle*

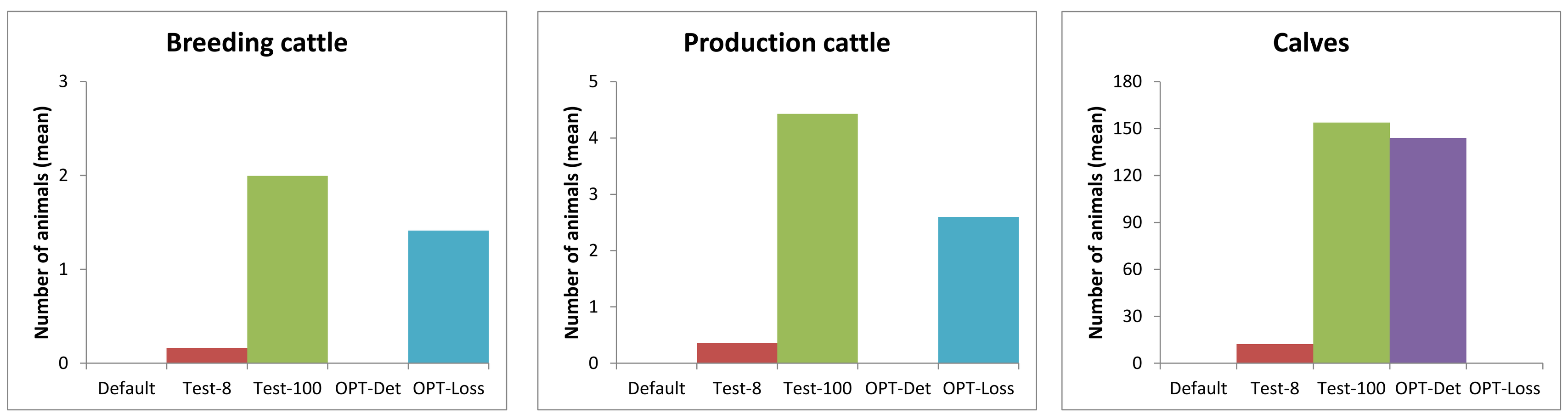


**Figure 2.** Number of bTB-infected cattle detected by additional testing

*Economic consequences of importing bTB-infected cattle*

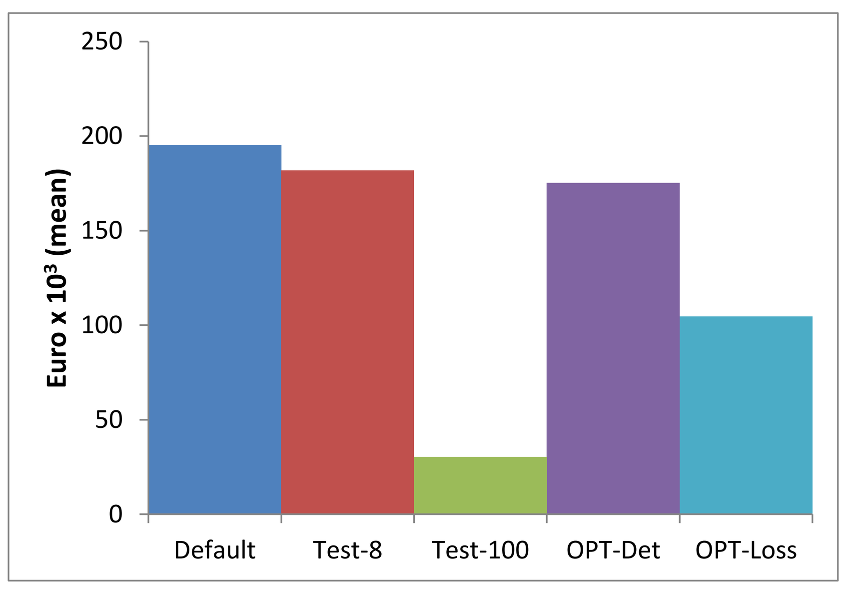


**Figure 3.** Economic impact of non-detected bTB-infected cattle

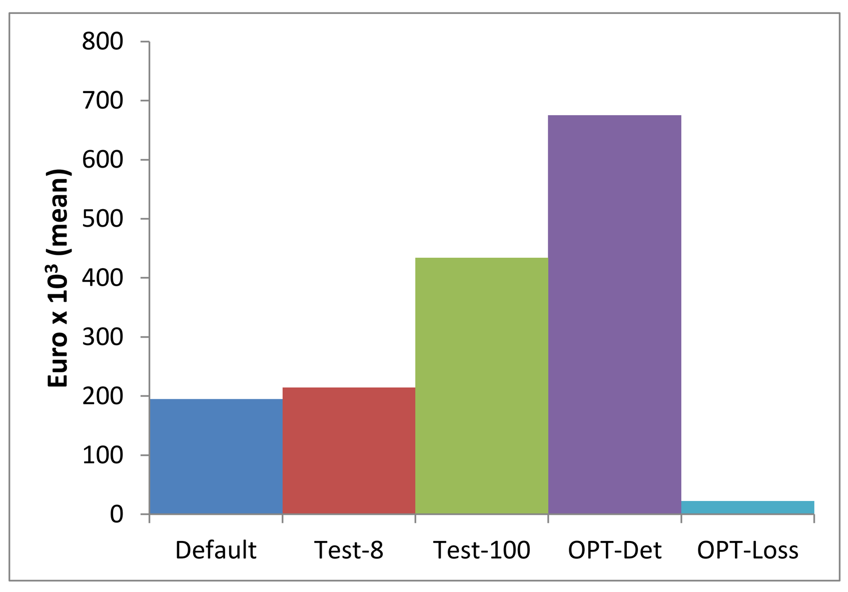


**Figure 4.** Overall economic loss due to importation of bTB-infected cattle

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