

Risk assessment of the re-emergence of bovine brucellosis/tuberculosis

C. Saegerman, S. Porter, M.-F. Humblet

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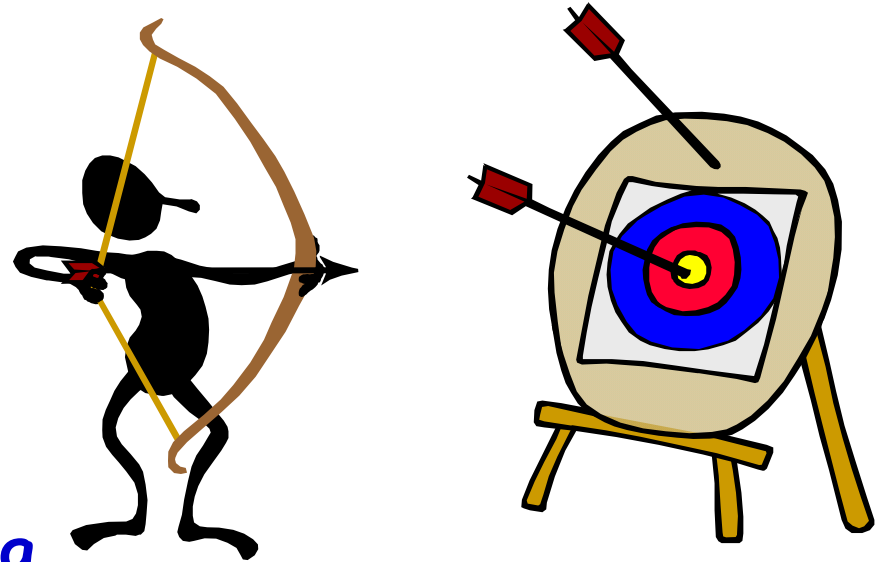
Research Unit in Epidemiology and Risk analysis applied to veterinary sciences
Department of infectious and parasitic diseases
Faculty of Veterinary Medicine - University of Liège

Claude.Saegerman@ulg.ac.be



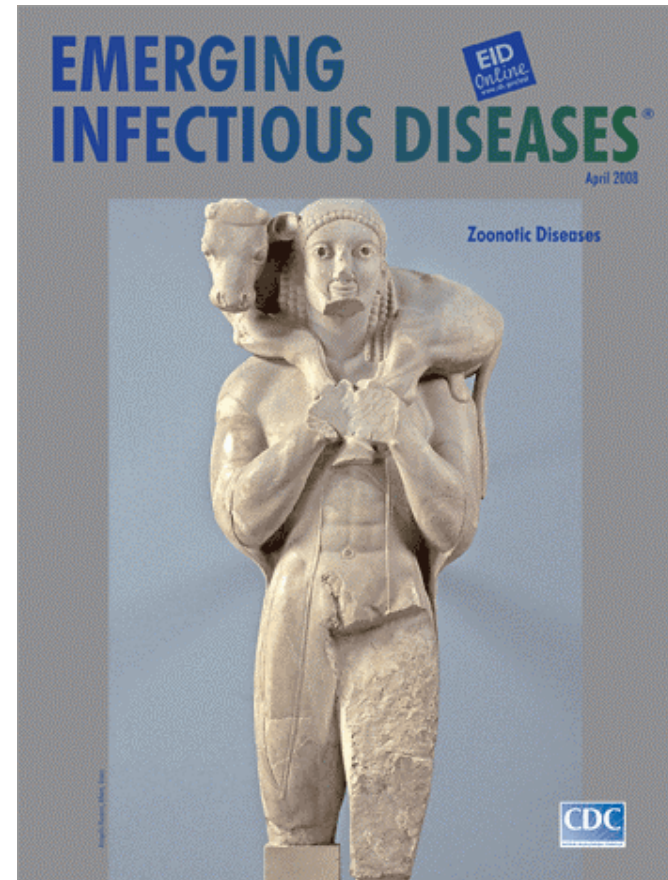
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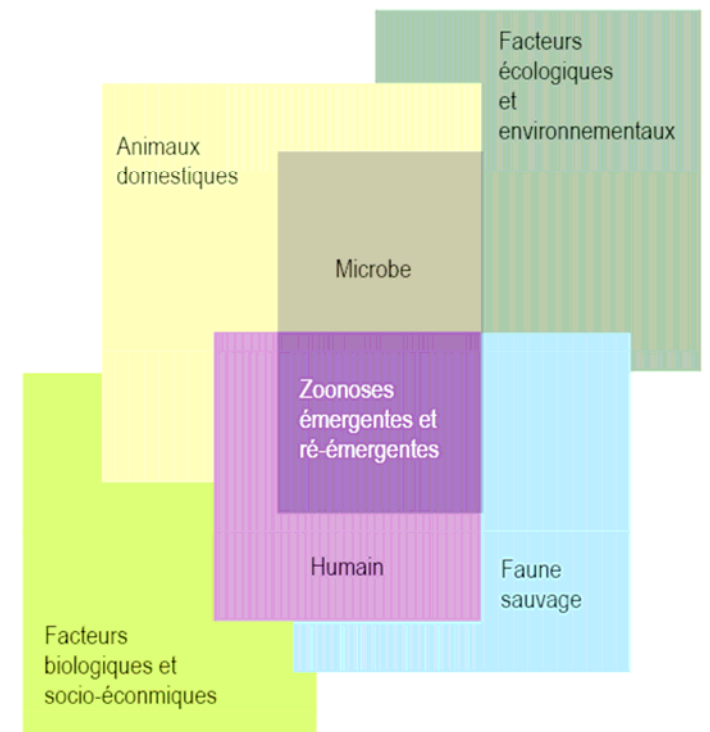
1. Context: definition

- Several definitions of an EID coexist but with a common denominator
- An EID is a disease of which the true incidence increases significantly in a given population and area and during a given period, in comparison with the usual epidemiological situation of this disease



1. Context: factors of emergence

- This increase in true incidence is due to several factors (e.g. change of pathogenicity or strain)
- Specific factors accelerate the emergence of a disease (e.g. climate), but it is difficult to establish a ranking of causes and mechanisms



Convergence model (King, 2004)



1. Context:

2 examples of diseases

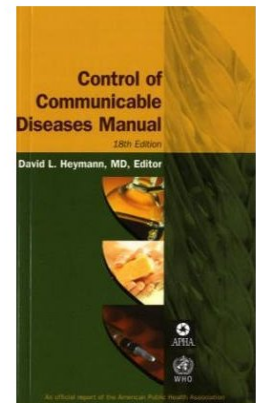
- **Bovine brucellosis (bB) and bovine tuberculosis (bTB) are:**
 - two World Organisation for Animal Health (OIE) reportable zoonoses and
 - of considerable socio-economic concern and
 - of major importance in the international trade of animals and animal products.
- **These are the main reasons to obtain and maintain a freedom status.**
- **In addition these diseases are 2 of the 7 neglected endemic worldwide zoonoses.**



1. Context: Why these diseases?

- With these 2 examples, we describe some original contributions that explain the usefulness of risk assessment as well as evaluation and optimization of surveillance system in the case of EID in a MS of the EU.

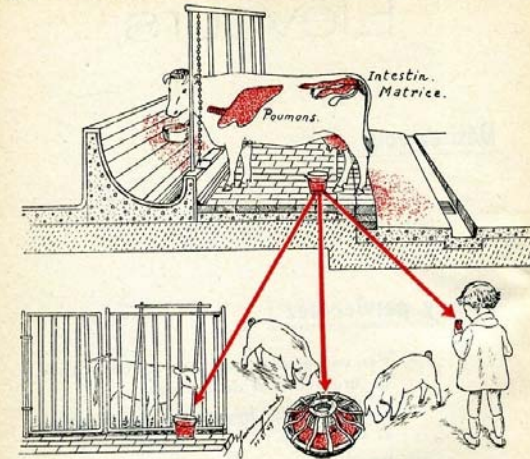
The Control of Neglected Zoonotic Diseases



2. Basic facts: bovine tuberculosis, bTB



- bTB caused by *Mycobacterium bovis* is a chronic, infectious and contagious disease of livestock, wildlife and humans.
- In livestock, particularly in cattle, the disease causes diminished productivity.
- In human, *M. bovis* colonises lungs and other sites (e.g. urinary-genital tract).



Une vache atteinte de tuberculose
peut à tout moment éliminer
des bacilles tuberculeux :

soit par le poumon . . .	la toux
soit par la mamelle . . .	le lait
soit par l'intestin	la diarrhée
soit par la matrice	les pertes purulentes



2. Basic facts: bovine brucellosis, bB

- bB is a widespread, economically devastating and highly infectious zoonosis.
- In cattle, infection is predominantly caused by *Brucella abortus*, and is usually detected in pregnant females through abortions.
- It can be passed to people via direct contact with livestock or by drinking unpasteurized milk products from an infected animal (undulant fever).

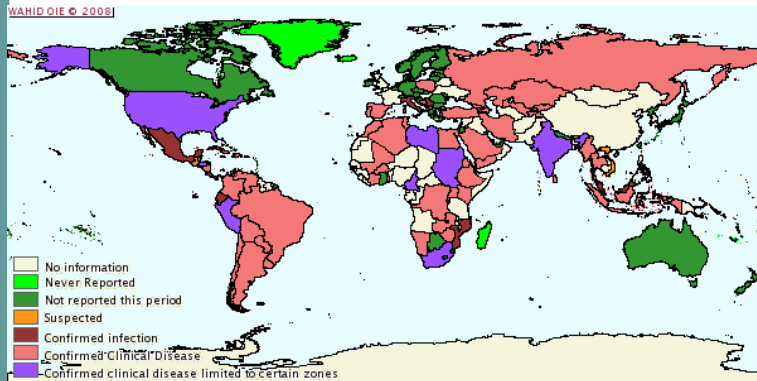


2. Basic facts: bB & bTB status

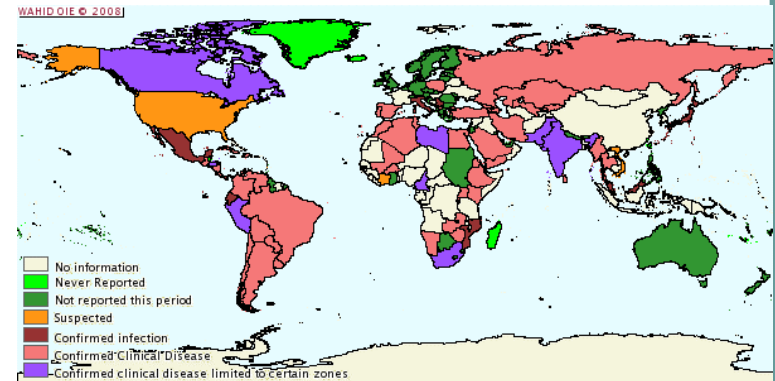
- In developing countries deficiencies in preventive and/or control measures are observed
- In developed countries, each disease has almost been eradicated after the implementation of appropriate preventive and control measures.
- However the situation in the EU is not uniform yet (year 2006):
 - bB: 13 non-OBF MS reported bovine cases of brucellosis (the situation is less favourable in Southern European countries and also in the Republic of Ireland but is improving with time).
 - bTB: 13 non-OTF MS reported tuberculosis cases (the highest prevalence of bTB is registered in the UK and IR)



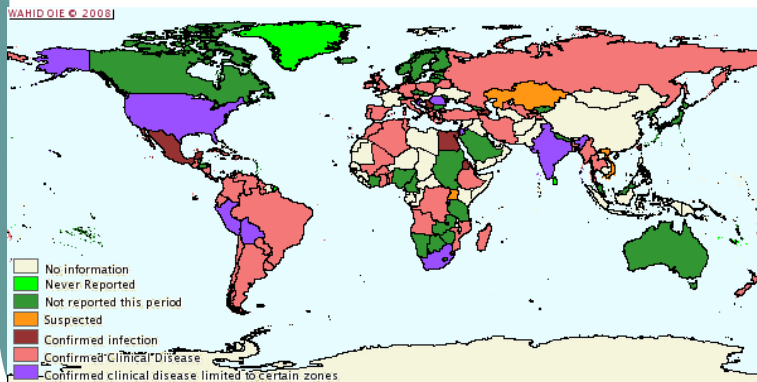
2. Basic facts: bB and bTB remain 2 worldwide problems



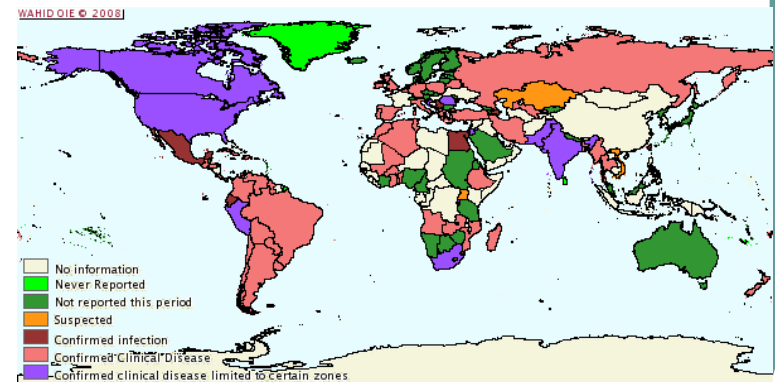
***Brucella abortus*, 1th semestre 2007**



***Brucella abortus*, 2d semestre 2007**



Bovine tuberculosis, 1th semestre 2007

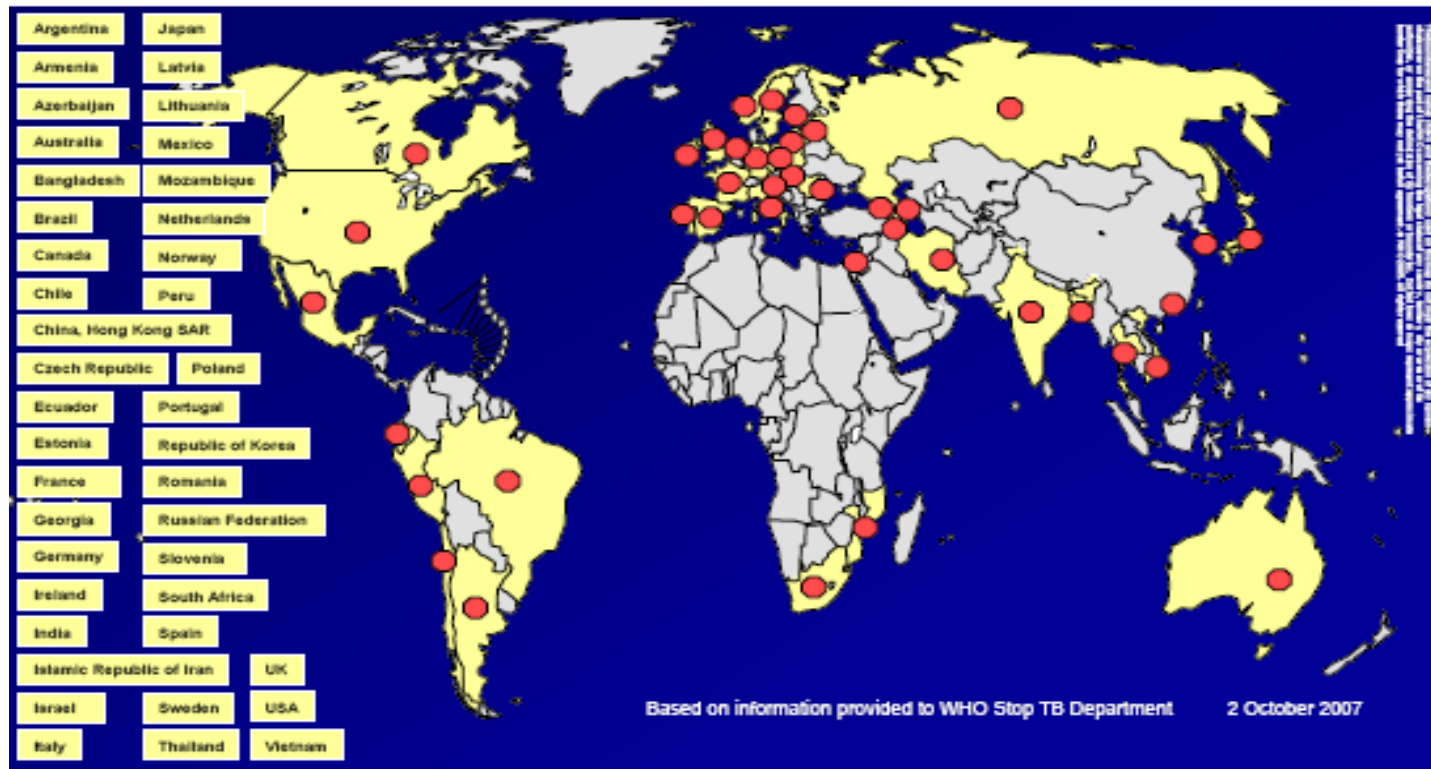


Bovine tuberculosis, 2d semestre 2007



2. Basic facts: new emerging danger can also occur

Countries with XDR-TB Confirmed cases to date



= Ultra high antibiotic resistance



Interest to maintain a free status

- Because of the EU MS are soon OBF and OTF.
- Because these diseases both have public health and international trade implications, all MS have an interest in obtaining and maintaining this freedom status.
- How can we deal with that?



3. Risk assessment



Hiatt and Goldman, Nature Editorial, 8 september 1994



3. Risk assessment

- is a tool that should be advocated to the World Trade Organisation in the context of trade policy (*sanitary and phytosanitary agreement*)
- used to assist in the choice of an appropriate national response strategy following an incursion of an EID
- should be made according to an independent, scientific and collective assessment
- should be performed taking into account current scientific knowledge (particular local situation, uncertainties)



3. Risk assessment

2 examples (Great-Britain)

- The first one is dedicated to the development of a quantitative risk assessment for the importation of bB-infected breeding cattle into a MS from other selected European countries

☞ Jones et al., 2004

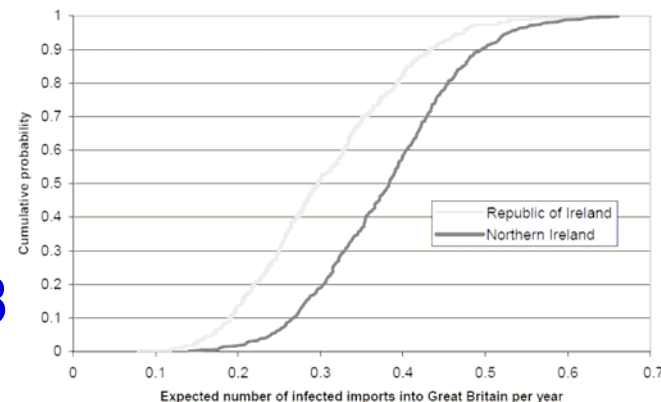
- The second is dedicated to the development of a simulation model of brucellosis spread in a cattle population of a MS under several testing regimes

☞ England et al., 2004



3.1. Quantitative risk assessment for the importation of breeding cattle

- With this assessment, the risk of importing brucellosis-infected breeding cattle into GB from Northern Ireland and from the Republic of Ireland was determined.
- Northern Ireland and the Republic of Ireland exported the largest number of cattle into GB and were not brucellosis-free during the development of the assessment in 2000.
- A risk of importing bB every 2.63 and 3.23 years was found respectively.



3.1. Quantitative risk assessment for the importation of breeding cattle

- Consequently, policy-makers introduced post-calving testing for all cattle imported into British herds.
- A similar decision was also applied in Belgium from 2003 according to a qualitative risk assessment and expert's opinion (Saegerman, 2004).
- Other quantitative risk assessments using a deterministic or probabilistic approach were also published (e.g. Sanaa et al., 2002).

TB in Cattle –
Reducing the Risk
Pre- and Post-movement testing in Great Britain



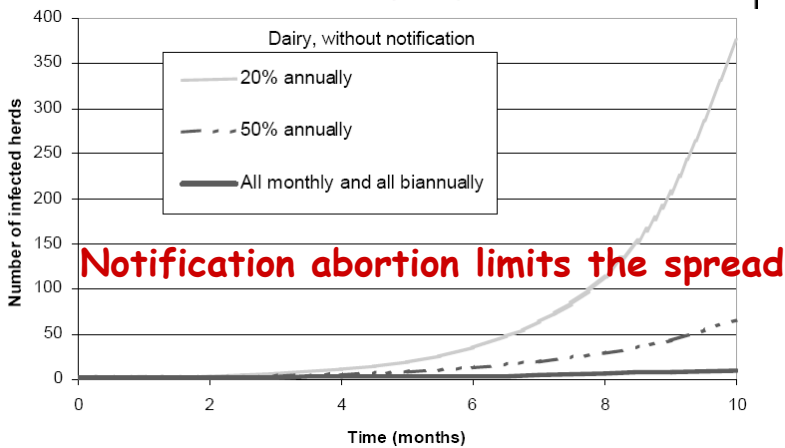
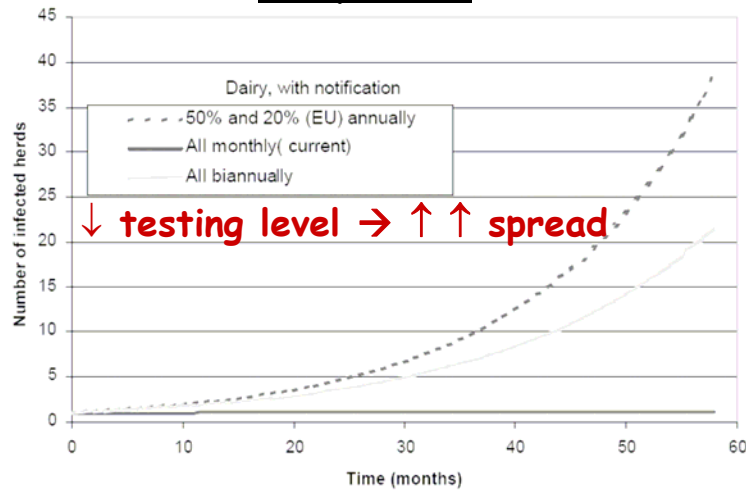
3.2. Simulation model of brucellosis spread

- A simulation model to determine the rate of brucellosis spread under a variety of testing regimes was developed.
- If brucellosis should be imported, the reduction of testing level would have a major negative effect on the rate of spread of infection between dairy herds.
- For beef herds, this reduction would have much less effect.

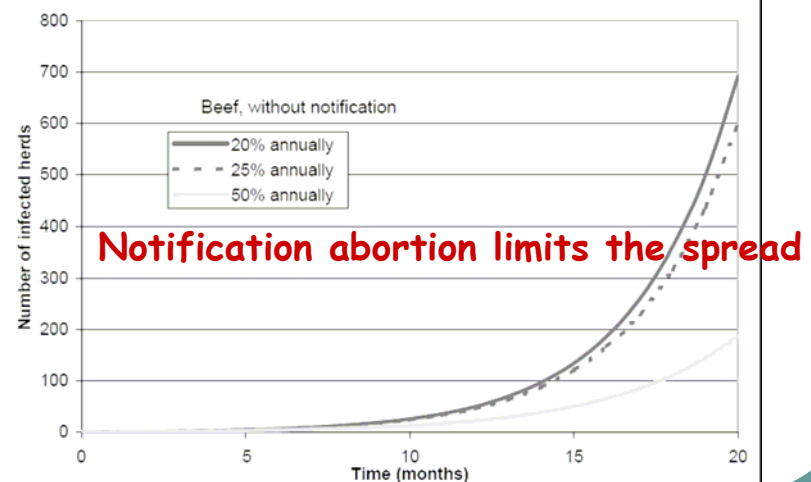
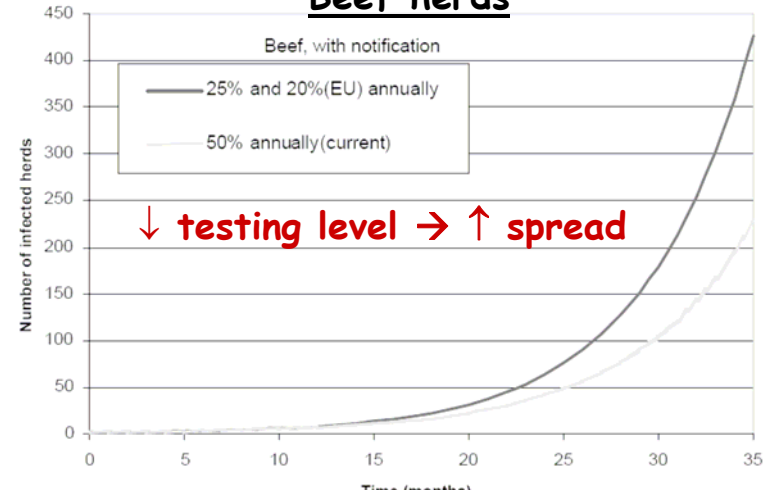


3.1. Predicted number of infected herds over time for different testing strategies

Dairy herds



Beef herds



4. Evaluation and optimization of surveillance systems for EID



- Despite the low prevalence of the EID at the time of its incursion, the surveillance system should be able to detect its presence as early as possible.
- Any delay in the detection of EID hinders the anticipated result of control measures.
- The key point for early detection is the sensitivity of the surveillance system (the ability to detect an outbreak as soon as possible).



2 examples

- The first one is dedicated to the development of an evaluation and optimization of surveillance systems for bTB (Switzerland)

☞ Hadorn and Stärk, 2008



- The second one is dedicated to the development of an original and useful methodology to evaluate skin test practices (Belgium)

☞ Humblet et al., Submitted





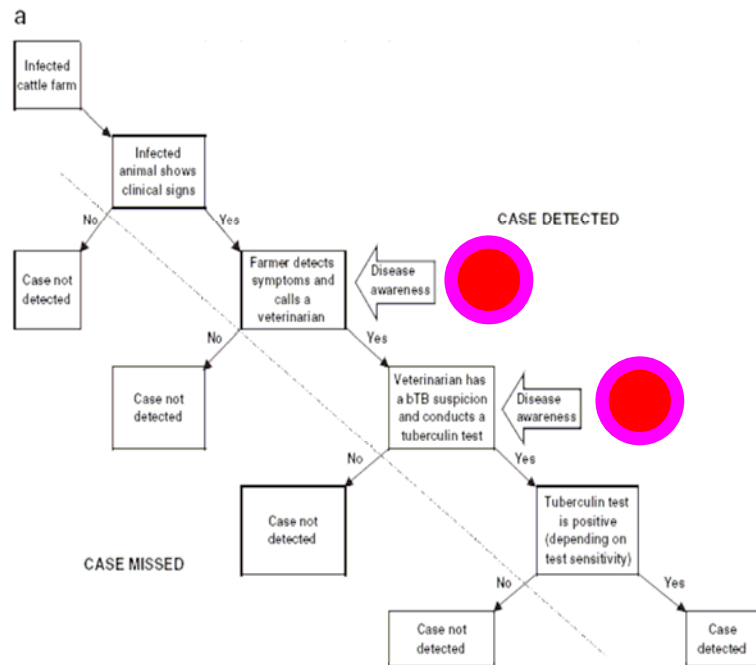
- Using scenario tree modelling, the sensitivity of passive and active surveillance system components can be quantified.
- A cost-effective surveillance system can be developed considering the contributions of each surveillance system components.
- In Switzerland the surveillance system for bTB consists in meat inspection at the slaughterhouse and in passive clinical surveillance on farms and of human cases (also named continuous surveillance).



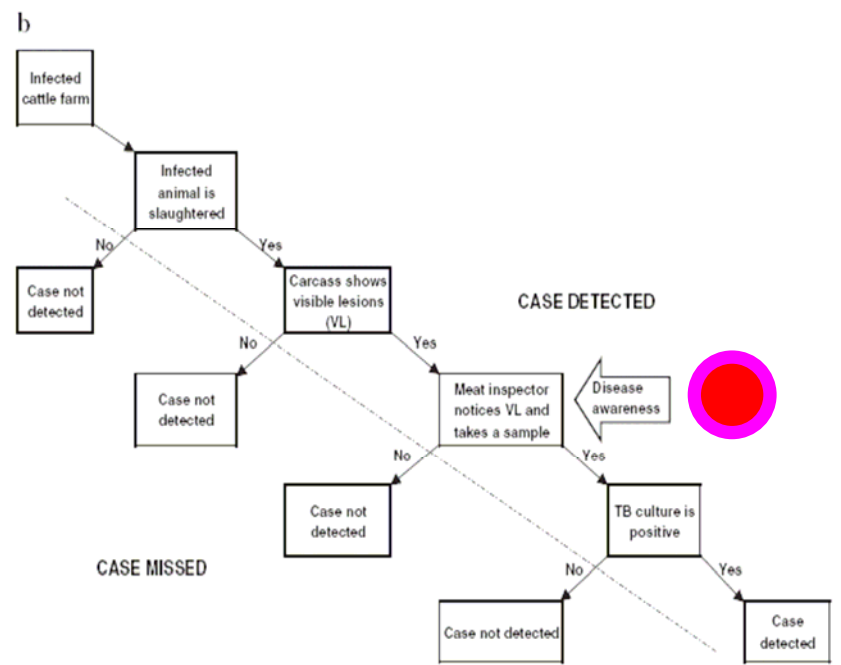
Scenario tree surveillance of bTB



Clinical surveillance in farm



Slaughterhouse surveillance



3.2. Simulation model of brucellosis spread

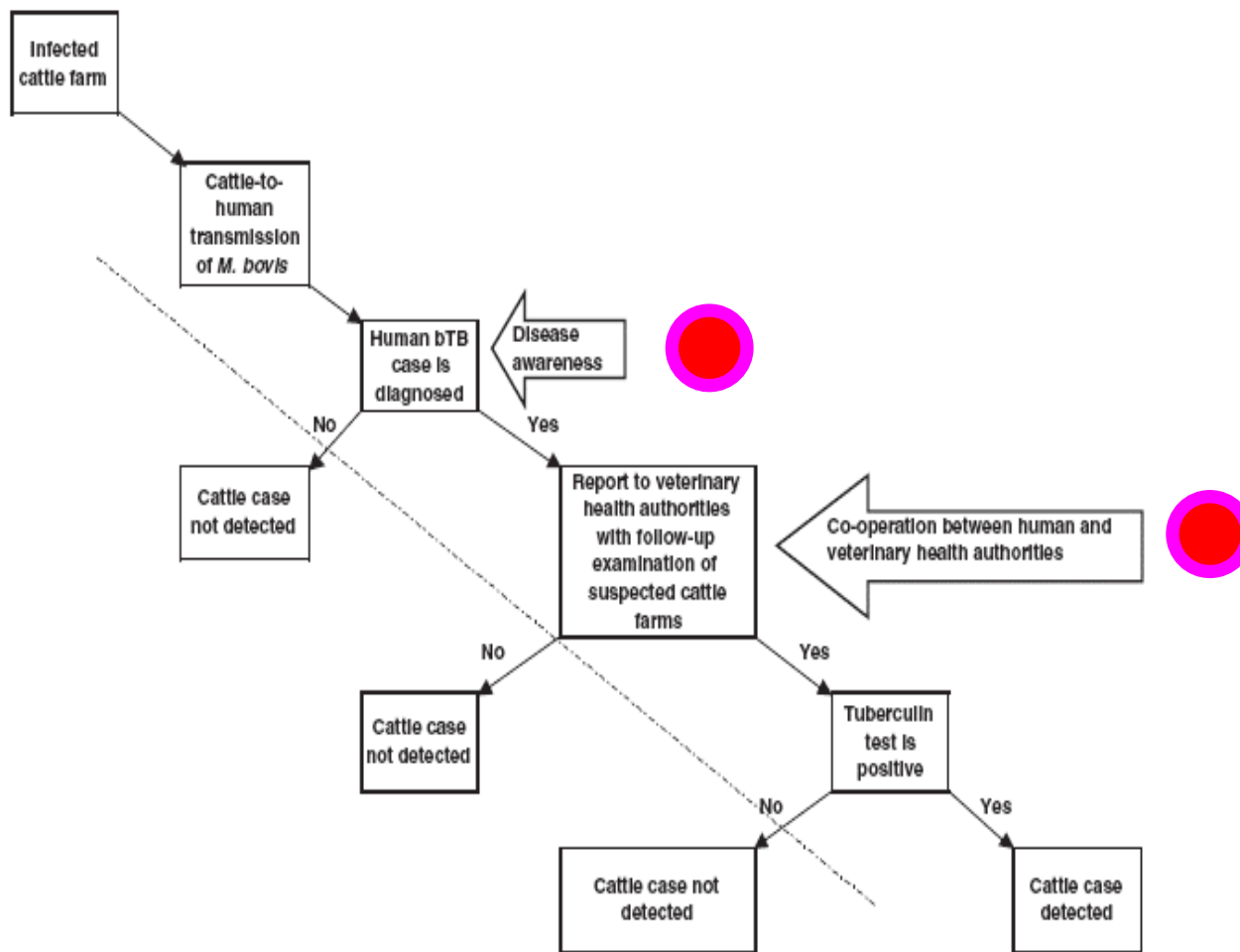


- In addition, the notification of any abortion is a very important additional mean of surveillance to reduce the spread of the disease.
- Consequently, policy-makers decided not to reduce the level of testing and to actively promote abortion notification.
- The same decisions were also applied to Belgium from 2003 according to a qualitative risk assessment and expert's opinion

(Saegerman et al, 2004).



Scenario tree surveillance of bTB in cattle through detection of humans cases



Scenario tree surveillance of bTB



- The sensitivity of clinical surveillance is quite negligible and disease awareness increases the sensitivity of meat inspection at the slaughterhouse (from 56% to 80%).
- In addition, a hypothetical random survey was also compared with a targeted survey in high-risk strata of the cattle population (herds in contact with wildlife and with numerous animal movements).
- The targeted survey seems more appropriate because of its 1.17-fold increased sensitivity compared to the random survey.





Evaluation of skin testing strategy

- Was performed by an anonymous postal questionnaire dispatched to veterinary bovine practitioners.
- Items regarding the skin test were included and answers were evaluated by a scoring scale drafted according to an international experts' opinion in the field of bTB.
- For each item, a score of 0 was recorded for the 'ideal' answer, a score of 1 represented an acceptable answer, whilst a score of 2 was given to an unacceptable answer.



Evaluation of skin testing strategy



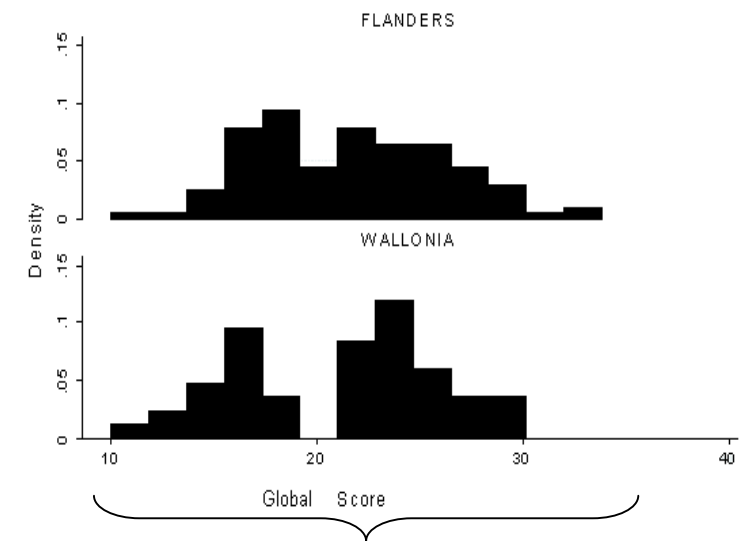
- A global score was calculated for each participating veterinarian by summing up the individual question scores and compared to the ideal null-score allocated to the expert's questionnaire.
- The analysis takes into account missing values:
 - Poisson regression after direct imputation (with a score of 2 if not response) and
 - Quantile bootstrapped regression (without imputation)





Evaluation of skin testing strategy

With imputation for missing values



Poisson regression

Without imputation for missing values



Quantile bootstrapped regression

- Results should pave the way to a harmonization of tuberculin test practices at the regional and country levels.



5. Some future prospects: changing the face of veterinary public health

- For EID, the hazards, the risk and the transmission modes could be changing in time and space.
- Our understanding is evolving. Food production (including primary production) and food consumption seem also to be changing.
- Veterinary public health needs to be more than a reactive response to human needs; it also needs to have a proactive input.

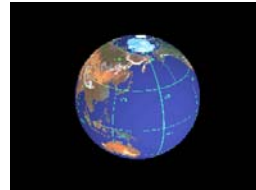
BVA CONGRESS

**Changing the face of
veterinary public health**



5. Some future prospects: Proactive input

- Extensive knowledge about pathogenicity, epidemiology and factors influencing the probability of infection for a specific disease are crucial (e.g. 3 levels: animals, herds, regions/countries).



- An interdisciplinary approach is required with the least assumptions possible.

5. Some future prospects

Proactive input

- Because most of the EID were detected, in first instance, by veterinary practitioners (e.g. BSE, BT), the development and implementation of clinical support tools are crucial.
- Permanent awareness and training of vets, including field and meat inspectors, would emphasise the importance of clinical surveillance.



5. Some future prospects

Proactive input

- Use of risk assessment (independent, collective and interdisciplinary approach).
- Use of simulation modelling of disease spread with no or few assumptions.
- Use of evaluation methods and optimization of surveillance systems to evaluate the test strategy or to identify the high-risk strata to conduct a targeted survey.



5. Some future prospects: Information, communication, uncertainties

- Quantitative epidemiology including risk assessment needs a lot of accurate and current (in case of emerging diseases, change is the rule) information data from the veterinary and medical worlds.
- In this context, communication is crucial.
- Concerning international trade, a clear, accurate and immediate communication in the framework of animal disease notification is essential to limit the spread of the disease and to ensure the mutual trust between countries.
- A clear communication about uncertainties in all phases of the decision process is also important.



5. Some future prospects: Millenium Development Goals



- EID are a challenge but represent also new opportunities for both veterinarians and physicians.
- The cost-benefit of a worldwide veterinary public health approach instead of an exclusively human approach would probably be considerably advantageous.
- For bB and bTB, an attractive option would be to include worldwide veterinary control/eradication of (re-)emerging diseases in the Millenium Development Goals.



Emerging infectious diseases



Thank you for you attention