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Towards the veterinary diagnostics of the future

Main topic : Surveillance and control of emerging diseases

**Disease eradication and surveillance: which method for which goal? (Example with BVD)**

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In disease control, eradication, and surveillance must be distinguished. Eradication aims at decreasing the prevalence until a goal of 0%. In the world, only a few diseases are recognized as eradicated, such as smallpox (1980) in humans or rinderpest (2011) in animals. Not all diseases are "eradicable"; it depends on the available tools and the will of decision-makers [1]. When the prevalence is sufficiently reduced, and if extinction is not achievable (often for financial reasons or exchanges between regions), a program of monitoring is implemented.

Bovine Viral Diarrhea (BVD) is very interesting to study regarding these concepts of eradication and surveillance because it is one of the most impacting and costly bovine diseases in the world [2] and because it is eradicable:

The main reservoir is known and identifiable: permanently infected (PI) animals, infected during embryonic life, born immunotolerant to viruses, and shedding the virus for life.

Reliable tools exist to detect PIs with around 100% of accuracy: Antigenemia, on individual samples, or PCR, which can be used on pools (positive pools need to be retested individually afterward, with less financial interest when the prevalence is > 0.3-0.5%).
Different plans have been implemented in different countries, which have all decreased prevalence, as opposed to countries without programs [3].

As control plans, there are two strategies:
- direct detection of the virus itself (PCR or ELISA Antigen test) generally based on tissue tag testing at birth: a fast, pretty expensive, but very effective system (from 1.4% to 0.05% prevalence in 2.5 years in one country [4])
- serological screening detecting antibodies produced against the virus as indirect proof of recent past infection (when a viral circulation is highlighted, a direct method is then used individually). Cost per year is less, prevalence is generally divided by 10, but in 15-20 years.

Vaccination is interesting at farm level when the disease is not controlled in the surrounding farms. But it is often incompatible with surveillance measures based on antibody detection.

Moreover, the decision factors that come into play in implementing a plan have been well described and can be applied to many other diseases, including human ones. To be successful, a control plan must be: [5]
- accepted: the losses must be clearly explained, and the return on investment too,
- understood: the program must be easy to understand and implement,
- mandatory: all must be required to participate,
- limited in time to be economically viable,
- effective: reservoirs (here PI animals) must be tracked and culled, and all traded animals must be tested negative beforehand,
- professional: the stakeholders must be well-trained and informed.

This review can thus inspire countries that have not yet implemented a program and also give some ideas on the management of other diseases where the same methodology could be applied.