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Brucellosis Control, Eradication and Prevention Strategies

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Strategic objective

- The choice of one of the possible general **strategies** against a disease condition

- In zoonoses:
  - **Prevention** of human infection
  - **Control** of the disease in animal populations
  - **Eradication** of the disease in animal populations

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Control

- All measures used to **reduce the occurrence of a disease** (or infection) already present in a population

- Main goal of a control program is to **reduce the impact** of the disease (or infection) on:
  - the **human health**
  - the **economy** of a region

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Eradication

- All measures which **eliminate** a species of infectious organism
- Main goal of an eradication program is the **disappearance of the infectious agent** from a given territory
- **Eradication is conceptually different from control:**
  - it is neither a casual nor an automatic consequence of a control program.
  - organization of activities and sanitary measures adopted are completely different from those implemented for a control program

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Prevention

- All measures aimed at **excluding the introduction** of an infectious agent in a geographical area in which it is absent (*foreign diseases*)

- All measures aimed at **excluding a disease** from an unaffected population

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The choice of a strategy

- The choice of a strategy depends on a number of factors:
  - **Epidemiology**
    - Patterns of the disease within animal and human populations
  - **Economy**
    - Available resources
  - **Organization**
    - Organization and skills of veterinary services
    - Animal husbandry practices
    - Infrastructures
    - Social customs

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The choice of a strategy

- Whatever the strategy adopted, it is extremely important to implement an effective **surveillance system** to:
  - **Monitor the program**
    - Prevalence and incidence at individual/herd level
    - Incidence of human infection
    - Performance of Veterinary Services
  - **Take corrective actions**
  - **Support decision making**

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Brucellosis control strategies

- **No action** on animal populations
  - Treatment of milk
- **Vaccination** of animals
  - Young and adult animals ("mass vaccination")
  - Only young animals
- **Vaccination** combined with **test-and-slaughter** policy
- **Test-and-slaughter**
  - Slaughter of reactors
  - Total depopulation

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Brucellosis control strategies

Strategy	Advantages	Disadvantages
Heat treatment of milk (without any action in animal populations)	The lowest cost	Unable to prevent infection in workers at risk
	No need for efficient veterinary services	
	Only basic technology required	Unable to prevent economic losses due to brucellosis in animals
	Prevention of human infection acquired from the milk	
Mass vaccination (young and adult animals)	Lower cost	Rev1 is a **pathogen** for humans: -vaccine induced abortions (public health risk) -excretion of vaccine strain in the milk (public health risk)
	Easy to manage	Economic losses (vaccine induced abortions)
	Herd immunity quickly established	Need for annual vaccination campaigns
		Serological test **not able to differentiate** infected/vaccinated -need for a long transition period before starting any animal testing -impossibility to monitor the dynamics of infection occurrence

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Vaccination of young animals

Strategy	Advantages	Disadvantages
Vaccination of young animals	Abortions minimized	Herd immunity slowly established
	Lower cost	Need for **efficient veterinary services**: -no testing (vaccination has to occur before pregnancy) -multiple access of the veterinary services to the flocks, longer window than the previous strategy to vaccinate animals
	No need for technological infrastructure	
Vaccination of young animals and elimination of the infected	Abortions minimized	Herd immunity slowly established
	The herd immunity reduces the incidence of infection and the costs for the elimination of reactors	Need for a **very efficient veterinary services**:
	Serological test are able to differentiate infected/vaccinated	-need to differentiate vaccinated/infected animals: access has to occur before puberty
	Need for a basic technological infrastructure (laboratory support)	-frequent access of the veterinary services to the flocks are needed, short window to vaccinate young animals

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Elimination of infected animals

Strategy	Advantages	Disadvantages
Elimination of Infected animals: control of infection by test and slaughter of reactors	Elimination of the sources of infection for other animals and for humans	**High cost** in short and long term: usually it is an intermediate phase leading to eradication
		Need for **efficient veterinary services**: -movement control
		Need for **advanced technological infrastructure**: -individual animal identification -laboratory support
Elimination of Infected animals: eradication of infection	Elimination of the sources of infection for other animals and for humans	**The highest cost** for short term, possible long term economic advantages
		Need for **efficient veterinary services**: -movement control -epidemiological investigation capabilities
		Need for **advanced technological infrastructure**: -individual animal identification -laboratory support -epidemiological support tools and facilities

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Control programs

- Any strategy to control *B. melitensis* can take a great advantage from a **preliminary vaccination program** aimed at reducing the incidence and the prevalence of the infection
  - when Brucellosis has high rates of occurrence
  - when transhumance and/or nomadism are used extensively

- When a significant **reduction** in flock **prevalence** has been reached, the control program should be reviewed and **alternative strategies** may be considered

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Vaccine strains

- **Live *Brucella melitensis* strain Rev.1**
  - Is the reference vaccine to immunize sheep and goats at risk of infection from any species of Brucella (*B. melitensis* or *B. abortus*)
  - When properly used, Rev.1 vaccine confers a long lasting protection against field infections
  - No other vaccine has been demonstrated effective in sheep and goats immunization against Brucellosis

- **Live *Brucella abortus* strain 19 or RB51**
  - Are the reference vaccines for cattle
  - May provide also protection against *B. melitensis* (only S 19)

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Brucellosis vaccines for ruminants

- **Strain 19** (S19 or B19) and **Rev.1** are the cheapest internationally recommended vaccines far large and small ruminants, respectively.

- They have be proved to be innocuous and efficient in the target species providing that:
  - they have been produced from the original strains,
  - according to GMP, and
  - that both the seed and the final lots are systematically controlled according to WOAH standards.

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Vaccination of adult animals

- It is frequently considered the first step in brucellosis control
  - It is really so easy to manage? Is it really a good choice?

- **Rev.1 vaccine is pathogenic for humans** and may cause abortion in pregnant ewes
- Live attenuated vaccines **are excreted *via* the milk, abortion and parturition fluids**
- Milk from flocks subject to vaccination of adult animals **should be heat treated** for long periods following the administration of vaccine

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Vaccination of adult animals

- In order to reduce the risk of abortion, the **vaccination should preferably take place during no-lactation periods**,
  - thus implying multiple visits of the flock by the veterinary services

- **Annual revaccination campaigns** are needed to maintain the required level of herd immunity (replacements)

- The effectiveness of the campaign (=assessment of the decrease in incidence of animal infection) cannot be properly evaluated as **the use of serological tests is totally impaired**

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Control, eradication and prevention

- **The three main strategies are not mutually exclusive**
- on the contrary they can be arranged in a cascade
- A strategy beginning with a control program, can be changed into an eradication program and, lastly, into prevention of the reintroduction of the disease

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Steps of a control/eradication program for brucellosis 1/4

First step: Control program

[Vaccination of adult and young animals]

Vaccination of young animals on voluntary basis

Is the number of herds/flocks participating to the program higher than a predefined threshold?

NO

YES

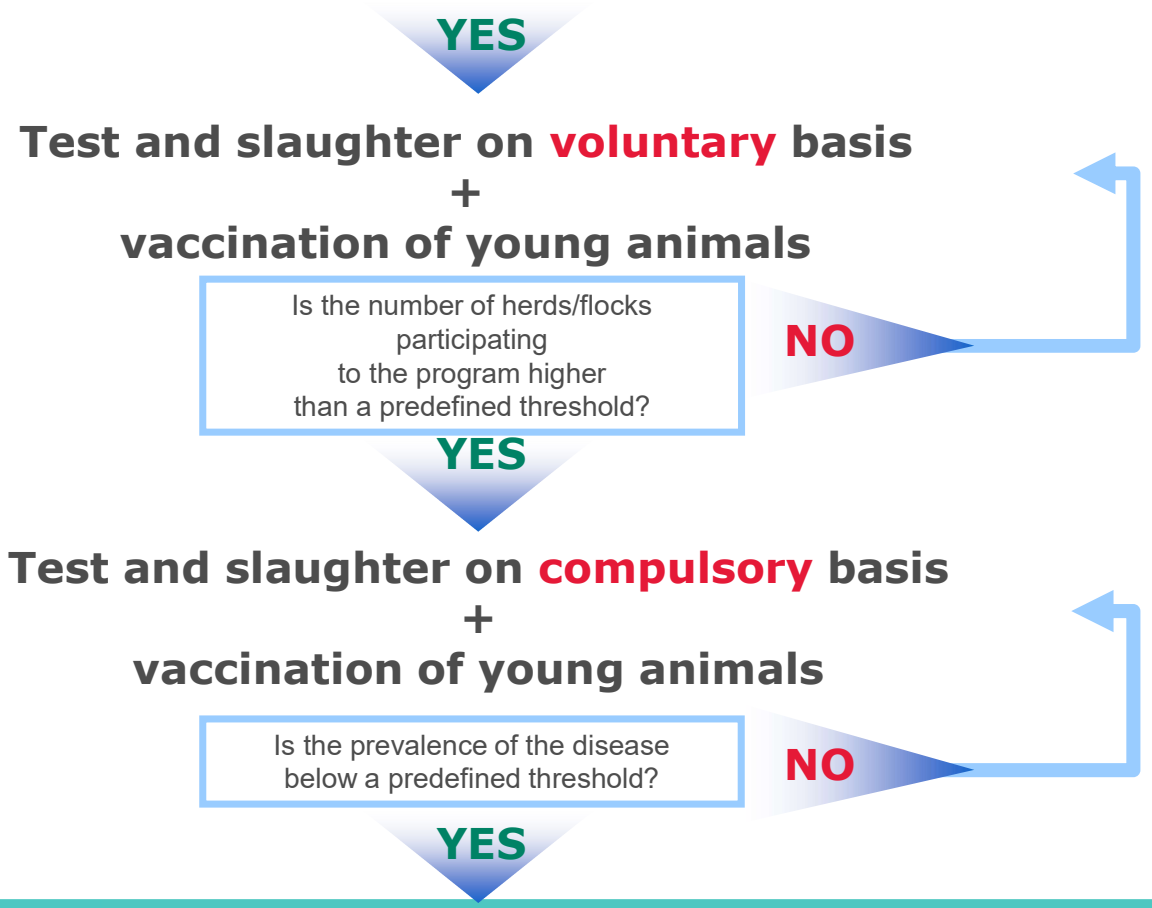
Compulsory vaccination of young animals

Is the prevalence of the disease below a predefined threshold?

NO

YES

Steps of a control/eradication program for brucellosis 2/4



Steps of a control/eradication program for brucellosis 3/4

YES

[Test and slaughter and prohibition of any vaccination]

Is the prevalence of the disease below a predefined threshold?
Do social and economical conditions allow it?

NO

YES

Start an eradication program (second step)

Steps of a control/eradication program for brucellosis 4/4

Second step: eradication program

Statement of the yearly objectives of the eradication program

- Test and slaughter
- Movement control and restrictions
- Identification of "problem herds/flocks"
- Strict surveillance of "problem herds/flocks"
- Surveillance of the whole system

Yearly analysis of achievements and revision of the yearly objectives of the program

When eradication is achieved

Third step: Prevention

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Evolution of control programs

- When a **significant reduction in flock prevalence** has been achieved, the control program should be reviewed
  - and **alternative strategies** may be considered

- **A central co-ordination structure** is needed to co-ordinate the vaccination campaigns and of follow-up activities, the surveillance, the evaluation of data and the re-planning of the program

- **A long-term planning is always necessary** to decide the phases of brucellosis control and the transition between phases.
  - The management of such a long-term control campaign usually needs the improvement of the veterinary information and reporting systems

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Main Requirements for Brucellosis Control

- **Long-term commitment** from all parties
- Application of **appropriate policies and control strategies**
- Reliable and science-based **data and information**
- **Estimation** of the real prevalence and incidence both in humans and animals

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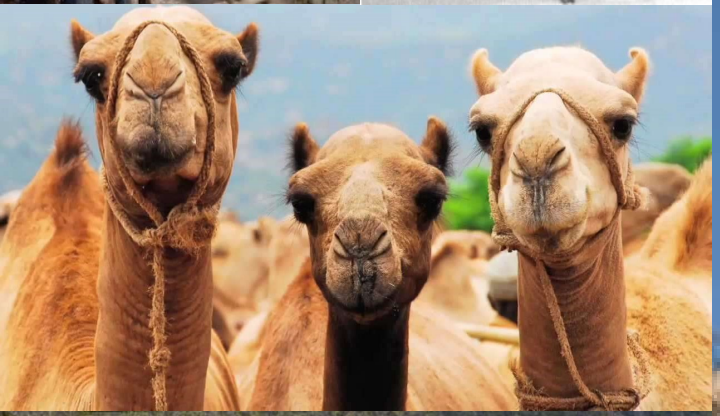
Main Constraints in Brucellosis Control

- **Weak veterinary capacity** (laboratory, epidemiology)
- Absence (or non adapted) **legal framework** for brucellosis control
- Lack of accurate and **reliable information** on the disease (both in humans and animals)
- **Control strategies** not well defined and programmes **not monitored** for progress
- Uncontrolled cross border and internal **movement** of animals
- Lack of **intersectorial collaboration**



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