

Principles of Zoonosis Prevention, Control and Eradication

There is an important distinction among the term prevention, control and eradication.

- ✓ **Prevention** is defined as inhibiting the introduction of a disease agent into an area, a specific population group or an individual.
- ✓ **Control** efforts consist of steps taken to reduce a disease problem to a tolerable level and maintain it at the level. The term control is more appropriate when a given infectious disease agent is already present. For example; an arboviral infection may be endemic in a wildlife reservoir in an area where eradication is not feasible, but its impact may be greatly reduced in people and domestic animals by vector control and immunization programs.
- ✓ **Eradication** is the final step in a disease control program. It consists of the elimination of a disease producing agent from a defined population or geographical area.. To achieve eradication of a disease producing agent from an area or population, it is necessary to obstruct transmission until endemicity (including carriers) ceases and prevent the reestablishment of the agent from imported sources of infection . The disease may be eliminated (brucellosis from a herd of cows; tuberculosis from herds in a political subdivision) yet remains a threat to animals in that population as a result of travel of susceptible animals out of the area or import of infected animal or animal products

The basic principles of zoonoses prevention control and eradication programs are focused upon breaking the chain of transmission at its epidemiologically weakest link. Three factors are involved: the reservoir, transmission from the reservoir to the susceptible hosts, and the susceptible hosts.

The following operational policies have been recognized as suitable, effective methods of zoonoses control:

- surveillance
- control in animals
- control of infective media
- prevention in man
- strategy selection.

Each policy will include measures which are appropriate for individual zoonoses and which will be applied in different ways according to available resources and local conditions.

SURVEILLANCE

During the implementation of a control program, constant surveillance is imperative for monitoring and evaluation purposes and to supply reports on any unforeseen occurrence of diseases or significant changes in epidemiological patterns. For a surveillance system to be effective, reliable information on specific diseases must be readily available so that data can provide "information for action".

Another essential element in successful surveillance is detailed knowledge of the territory, which should include local factors such as the characteristics of human and animal populations, existing habitats, climatic and geographical features.

1. **Testing** of accessible animals, man and biological materials is essential in order to assess the presence of a disease and to establish the pathogen(s) involved. Among others, the following zoonoses typically require regular testing: brucellosis, equine encephalomyelitis, glanders, leptospirosis, rabies, Rift Valley fever, tuberculosis.
2. **Slaughterhouse surveys** are important in controlling certain diseases, such as brucellosis (especially in detecting and monitoring swine infection), echinococcosis/hydatidosis, taeniosis/cysticercosis and trichinellosis.
3. **Isolation and typing of the zoonotic agent** is needed in several infections (equine encephalomyelitis, leishmaniosis, Rift Valley fever, salmonellosis).
4. **Epidemiological studies** provide essential knowledge of zoonoses and help to determine the most suitable methods of control. They are especially useful in planning control of infections such as echinococcosis/hydatidosis in areas at risk, leishmaniosis, leptospirosis (serological surveys), rabies, salmonellosis, tularaemia (assessments of incidence in man and animals and identification of sources of infection associated with arthropods, animals, environment and crops).
5. Collection of **statistical data on dog and other animal populations** is important in preparing strategies and launching campaigns for the control of zoonoses having the dog as a main vector, notably echinococcosis/hydatidosis and rabies.
6. The use of animals for monitoring zoonotic infections (**sentinel animals**) is recommended in some control programmes (e.g. campaigns against equine encephalomyelitis). In some cases

(equine encephalomyelitis, Q fever) the human disease serves to monitor the presence of the infection in animals, but this should not be taken as a rule. Veterinarians should know the zoonotic infections which are present in the animals of their region.

7. **Notification** of certain diseases in man and animals is compulsory in a number of countries and represents a basic step in overall surveillance policy. Some of the major notifiable zoonoses are brucellosis, *Cochliomyia hominivorax* infection, rabies and Rift Valley fever.

CONTROL IN ANIMALS

To minimise the risk of transfer or introduction of zoonotic agents through the movement of animals, **quarantine** is strongly advocated (and for certain infectious • diseases, imposed by law), especially when animals are moved over long distances, as with livestock import-export, pet trade and tourism.

1. **Test and destruction** of diseased or infected animals is often recommended to control certain zoonoses (brucellosis, glanders, leishmaniosis, salmonellosis of poultry, bovine tuberculosis).
2. **Test and segregation** of infected stock is recommended for other zoonotic infections such as leptospirosis.
3. **Immunisation of exposed animals** can be extremely effective. Vaccination campaigns may greatly assist in the control of a number of different zoonoses including brucellosis, equine encephalomyelitis, leptospirosis, rabies, Rift Valley fever, salmonellosis (when feasible). New technologies are being developed both to produce more efficient vaccines and to extend their use as in the oral vaccination of foxes against rabies.
4. **Treatment of sick and infected animals** proves a valuable measure in combatting some infections such as *C. hominivorax* infection, echinococcosis (worming of dogs and destruction of the excreta), leishmaniosis, leptospirosis, psittacosis-ornithosis.
5. **Restriction of animal movements** is an effective policy in dealing with zoonoses such as equine encephalomyelitis, rabies and Rift Valley fever.
6. **Control of animal populations** is an essential component of any programme aimed at minimising the spread of infections. This may include vertebrates such as dogs (echinococcosis/hydatidosis, leishmaniosis, rabies), foxes (rabies), cats (toxoplasmosis) and rodents (leishmaniosis, leptospirosis, toxoplasmosis) as well as arthropods (equine encephalomyelitis, leishmaniosis, Rift Valley fever, tularaemia, etc.). Concerning dogs and cats, it should be stressed that control must include proper feeding hygiene (e.g.

raw meat and offal should not be used as feeds). This is especially true for stray populations, but also for owned animals .

7. In dealing with arthropods, **biological control** may be applied, a typical example being the use of sterile males in the campaign against *C. hominivorax*.
8. **The prohibition to slaughter** diseased animals must be enforced in the control of some diseases (anthrax, glanders, Rift Valley fever).
9. **Decontamination of feed** is a valid means for coping with a number of food-borne zoonoses among which typical examples are salmonellosis and trichinellosis.
10. **Raising of pathogen-free animals** is useful in the case of salmonellosis in poultry.

Salmonellosis requires other control measures such as strict hygienic management of livestock, poultry farms and domestic animals (including pets such as tortoises).

The development of intensive farming techniques has proved to be associated with the decrease and even eradication of such zoonoses as echinococcosis/hydatidosis and trichinellosis.

CONTROL OF VECTORS AND VEHICLES

This form of control includes measures to prevent zoonotic pathogens from being transmitted to non-infected animals and man and to disease-free areas, by means of vectors (chiefly arthropods), vehicles (e.g. foodstuffs or contaminated fomites) and carrier hosts.

1. **Hygiene and control of the environment** are among the best general actions for achieving this primary form of control. For instance, the control of fasciolosis and leptospirosis is often linked to and follows on land reclamation campaigns (drainage and flood control of the environment, conversion from wet to dry farming).
2. **Destruction of pathogenic material** can help to control infections. Important examples are brucellosis (safe disposal of aborted fetuses), echinococcosis/hydatidosis (destruction of dog faeces and infected viscera from secondary hosts) and tularaemia (destruction of infected offal, carcasses and skins).
3. When applicable, thorough **disinfection** of contaminated areas will greatly assist in reducing the spread of some zoonoses (brucellosis, salmonellosis, tuberculosis).
4. **Feed hygiene** is required to combat, among others, salmonellosis (decontamination of feed), toxoplasmosis (meat hygiene) and trichinellosis (cooking of refuse).
5. **Arthropod control** is an essential strategy in reducing sources of infection, as in the case of equine encephalomyelitis (removal of mosquito larvae and use of insecticides in

domestic habitats), leishmaniosis (sandfly control), Rift Valley fever (use of insecticides) and toxoplasmosis (fly control).

6. **Biological control**, as mentioned above, should also be included in this group of Measures.

PREVENTION IN MAN

Man is the final and most important consideration in veterinary public health actions and special priority must be given in all programmes to securing better health and welfare standards for human communities. All prophylactic measures focused on the specific protection of man against serious zoonoses should be seen as major elements in control, and should be accompanied by a series of primary operational strategies.

1. **health education** :Much of the success of a zoonoses control plan depends on **health education**. Public awareness of health risks connected with certain zoonotic infections can greatly assist in reducing the spread of diseases such as brucellosis, echinococcosis/hydatidosis, leptospirosis, rabies, Rift Valley fever, salmonellosis, toxoplasmosis and tularaemia.

The targets of this education are generally multiple. For instance, in the case of brucellosis, health authorities should be convinced to recommend pasteurisation of milk, consumers to use safe milk and cheese and farmers to dispose safely of suspect materials; vaccination of animals should also be accepted and applied whenever this strategy is chosen.

2. **Occupational health education** is directed specifically at categories of workers especially prone to certain zoonoses, which again include brucellosis (education of farmers, personnel in slaughterhouses and biological laboratories), chinococcosis/hydatidosis (farmers, shepherds, kennel personnel), leptospirosis, rabies, Rift Valley fever and salmonellosis.
3. **Vaccination** is especially effective in protecting at-risk categories against zoonoses such as equine encephalomyelitis, leptospirosis, Rift Valley fever and tularaemia. All veterinarians and related personnel should be vaccinated against rabies (in infected areas), tetanus and any other vaccine-preventible infection which may be a hazard in their region.
4. **Post-exposure treatment** is sometimes imperative as in the case of rabies infection. Proper **food hygiene** (especially regarding food of animal origin) includes safe dietary habits and is of value in dealing with brucellosis (pasteurisation or boiling of milk and sterilisation

of dairy products), Rift Valley fever, salmonellosis and toxoplasmosis (cooking of meat and meat products before consumption, high standards of hygiene in kitchens and catering facilities) and tularaemia (thorough cooking of meat of wild rabbits, hares and rodents).

5. **Arthropod control** should be included whenever arthropods are or may be vectors of zoonotic infections such as equine encephalomyelitis (destruction of mosquito larvae and breeding places, use of protective screens in dwellings), leishmaniosis (control of sandflies and reduction of contact with humans), Rift Valley fever (insecticide control in human habitats), salmonellosis (protection of food against insects) and tularaemia (protective measures against arthropod bites in endemic areas).

6. **Rodent and lagomorph control** is required for zoonoses in which these species act as main vectors (leishmaniosis, plague, tularaemia).

7. **Proper pet feeding** Zoonoses which are associated with ownership or contact with pets and whose transmission may be dependent upon pet feeding can be avoided by observing specific dietary hygiene rules. **Proper pet feeding** may be extremely helpful in controlling some zoonoses including echinococcosis/hydatidosis (avoid feeding dogs raw meat and offal), salmonellosis (whenever possible, ensure that pets are not exposed to dietary sources of *Salmonella* infection), toxoplasmosis (treat refuse and meat products before feeding to animals) and tuberculosis .

8. Immunodepressed persons are especially at risk from zoonoses such as Chagas' disease, cryptococcosis, cryptosporidiosis, giardiasis, isosporosis, leishmaniosis, mycobacterioses, pneumocystosis, salmonellosis, strongyloidosis and toxoplasmosis. Toxoplasmosis also represents a very serious danger for pregnant women who are seronegative to *Toxoplasma*.

STRATEGY SELECTION

The choice of an operational strategy against a zoonosis must be based on the availability of control measures, existing epidemiological, social and economic restraints and on exploitable resources. The following main options may be offered :-

1. **eradication**, if the zoonosis is not extremely widespread and/or if its impact on the public health and economy of the region is unbearable. This option requires the provision of suitable and accessible control measures. It has been applied to brucellosis, *C. hominivorax* infection, glanders, rabies and tuberculosis (bovine);

2. **coexistence with the disease**, with acceptable consequences. This option is chosen when the infection is widespread and resources are not available for its eradication. This option has been applied to different endemic zoonoses such as brucellosis (often controlled by vaccination only) and rabies (reduction of fox and stray dog populations);
3. **no specific action**: this course may be imposed by the lack of resources, by the presence of other problems which take priority, or by the fact that no reliable control measures can be taken, save health education (Q fever and toxoplasmosis).

In a number of cases, a decision must be taken as to whether the control of a zoonosis should be integrated into the normal activity of veterinary public health services or whether special programmes are advisable. In taking such a decision, the possibility of a change in priorities should be considered. For example, an epidemic of foot and mouth disease (FMD) would interfere with a vaccination campaign against brucellosis, since all personnel and resources would be moved from brucellosis control to FMD eradication.

References:

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