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Principle of the Animal Diseases; Eradication, Prevention, Mitigation and Control

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Summary: To create disease free environment: good management of farm animals and disease eradication, prevention, mitigation and control of disease is really important. An emerging disease is a disease diagnosed for the first time and re-emerging disease' is the disease reappearance in a defined time period and location. Quarantine or Isolation, Slaughter/culling (test and slaughter, stamping out, preemptive culling), vaccination, animal movement control and therapeutic treatment and prophylactic treatment are a key factors for strategies of disease control. Out of the above disease elimination program, prevention (good management and vaccination) is the best disease control method in Ethiopia. Vaccination is the introduction of vaccine in to the body to produce immunity to specific diseases.
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1. Introduction to some terminologies

Disease is any deviation from **health** (state of complete physical, mental, social wellbeing not merely the absence of disease)**. Epidemic (epizootic in animal health) or Outbreak of disease or infection** is the occurrence of one or more *cases* of a *disease* or an *infection* in an *epidemiological unit*. Occurrence cases more than expected (endemic). **Endemic (enzootic in animal health) disease** is regular occurrence of disease in particular area. **Sporadic disease** is occurring of the disease at irregular interval or at occasional condition. **Pandemic disease** is an outbreak (ob) disease over a wide geographical area and affecting a large proportion of the population, example corona disease (COVID 19). **Prevention of disease** is taking any measurement or activity **before** the occurrence of disease, example prophylaxis vaccination. **Control of disease** is taking any measurement or activity **after** the occurrence of disease or Reduction of the morbidity and mortality from diseases and a general term implementation of all measures intended to reduce incidence of prevalence of the disease, example giving of drug for diseased animals. **Eradication of disease** is refers to the regional extinction of an infectious agent, example FMD eradication in England and eradication of Rinderpest globally. **Mitigation of disease** is making of less severe, serous or painful disease in once occurred disease. **Target population** is accessible and/or at risk - Population about which statistical inference will be made (general population at-risk) should be identified and clearly defined or estimated. **Epidemiological unit** is a group of animals with a defined epidemiological relationship that share approximately the same likelihood of exposure to a pathogen that is village, Pen, herd or animal. **Suspected case definition** is general case for animal or farm: clinical signs and rapid test kits. **Confirmed case definition** is clinical signs and confirmation laboratory test (Ararsa, 2016).

2. Emerging diseases

An emerging disease is a new infection resulting from the evolution or change of an existing pathogenic agent, a known infection spreading to a new geographic area or population, a previously unrecognized pathogenic agent or a disease diagnosed for the first time.

3. Re-emerging diseases

'Re-emerging disease' is the disease reappearance in a defined time period and location, of a disease considered to have been eradicated or controlled in the past. More of them (emerging and re-emerging) are zoonotic (75%).

4. Notifiable disease

Notifiable disease is a disease that should be reported to national veterinary authority. The reasons for requiring notification of such animal diseases are based on: They can spread quickly, they can cause serious damage to the species in question, they cannot be prevented or controlled by normal commercial methods (their control is beyond the capacity of individual practitioner and individual farm) and they present a serious threat to public health.

5. Tropical infectious diseases

Those disease which are mainly prevalent in the tropics and subtropics, because of: Climatic factors, example vector borne diseases like Trypanosomosis, RVF, LSD, Socioeconomic factors, example disease of (and) related to draft animals, disease that are not controlled in the tropics but controlled in the developed world example rabies and Wildlife interaction, example FMD SAT viruses (Ararsa, 2016).

6. Disease Prioritization

The prioritization of a disease has been defined as the "Organization of listed diseases into a hierarchy/ ordering, considering the irrespective impacts, such impacts like: Animal health impact, human health impact, economic impact, social impact and environment impact.

It is an aid for decision making process. Optimizes and enhances effective utilization of resources (financial and human means, equipment, etc.) in animal health policies and sanitary actions at different levels. To develop focused strategy that would enable targeting specific diseases. Justify the investment of scarce resources in the prevention and control of diseases. It is considered as important for appropriate targeting of research funds to diseases in defined priority areas.

7. Principles of disease control

Disease control means simply reducing disease spread and/or impact of the disease in infected individual. This can be done via eliminating source of the disease agent, increasing resistance of the host to disease agent and Preventing contact (reducing exposure) between susceptible animals and disease agent (Ballard and Rockett, 2009).

8. Strategies of disease control

Strategies of diseases control here refers the control measures that can be applied in the control of infectious diseases. These include: Quarantine/ Isolation, Slaughter/culling (test and slaughter, stamping out, preemptive culling), Vaccination, Animal movement control and Therapeutic treatment and prophylactic treatment.

8.1. Quarantine

Quarantine is the isolation of animals that are either infected or suspected of infected. It is used to isolate animals when they are imported from countries where exotic diseases are endemic, example quarantine of heifers imported from Kenya for ECF /risk. It is also used to isolate animals suspected of being infected, until infection is either confirmed by clinical examination or laboratory testing.

Infected animal in a herd can also be isolated until it become noninfectious. The period of quarantine depends on the incubation period of the agent, the time taken for infection to be confirmed, or the time taken for an infected animal to become non-infectious (either with or without treatment), example Quarantine of dogs biting animals or humans for 10-15 days (Ballard and Rockett, 2009).

8.2. Slaughter/Culling

In eradication campaigns, infected or in-contact animals may be slaughtered to remove source of infection. **Test and slaughter**: used in eradiation of endemic diseases from herds often involves testing all animals in a herd and culling those testing positive, example Bovine TB.

8.3. Stamping out policy

Stamping out policy is killing the animals that are affected and those suspected of being affected in the herd and where appropriate, those in other herds that have been exposed to infection by direct or by indirect contact of any kind likely to cause transmission of the causal pathogen. All susceptible

animals, vaccinated or unvaccinated, on an infected premises should be killed and the carcasses destroyed by burning or burial, or by any other method which will eliminate the spread of infection through the carcasses or products of the animal killed.

8.4. Pre-emptive/ring/'firebreak' culling

Culling non-infected or non-exposed animals in premises around outbreak sites with aim of preventing spread of the disease by exhausting susceptible animals

8.5. Animal movement control (movement restriction and regulation)

The movement of animals is often banned or restricted during epidemics and eradication campaigns to reduce the risk of disease transmission. A ban of animals movements enacted by competent authority nationally. Animal movement from place to place should always be accompanied by movement permit/certification such as animals' identification and movement regulation of Ethiopia and certification of animal during import and export is another method of disease control through movement regulation (Ballard and Rockett, 2009).

9. Veterinary Vaccine

They are preparations containing antigenic substances which are administered for the purpose of inducing a specific and active immunity against diseases provoked by bacteria, virus, or other microorganisms by parasite or antigenic substances produced by these organisms and rendered harmless whilst retaining all or part of their antigenic properties.

9.1. Vaccination

Vaccination is the introduction of vaccine in to the body to produce immunity to specific diseases. Vaccination can confer immunity to many bacteria and viruses and some helminthes. Vaccination reduces disease spread either through decreasing susceptibility or infectivity or both. In such way vaccination necessary by more individuals protected, fewer individuals infected lower force of infection and higher age at infection.

Two methods of vaccination application

1) Routine /blanket vaccination is vaccinating the whole population routinely to prevent occurrence of disease. **2) Strategic vaccination (emergency vaccination) is** vaccination organized strategically to prevent spread of disease from endemic areas, and spread of disease when epidemics occurs. **2.1) Ring vaccination** is animals in an area surrounding an infected region are vaccinated to provide a circumjacent barrier against spread of infection. It's an option for containing an outbreak. **2.2) Barrier vaccination** is a barrier, not completely circumscribing at infected region. **2.3) Suppressive vaccination** is practiced both within and around region where an outbreak occurs. These three strategies are applied in countries that do not routinely vaccinate (Kahn, 2010).

9.1.1. Herd immunity

Herd immunity (community immunity, population immunity) is a form of indirect protection from infectious disease. It occurs when a large percentage of a population has become immune to an infection, thereby providing a measure of protection for individuals who are not immune. In a population in which a large number of individuals are immune, chains of infection are likely to be disrupted, which stops or slows the spread of disease. The greater the proportion of individuals in a community who are immunized the smaller the probability that those who are not immune will come into contact with an infectious individual.

9.2. Type of vaccine

Vaccines can be killed, live, toxoid, autogenous and serovaccine. **a) Killed vaccines** are produced by inactivating the infectious agent (so it cannot replicate in the host body) without altering immunogenicity of protective proteins. They induce predominantly humoral type of immunity that is antibody mediated. Generally they require two doses with an appropriate interval. Booster dose of inactivated vaccines are administered annually, example black leg, pasteurellosis,

b) Live vaccines are prepared either by using less virulent or by attenuating highly virulent strain/type of an infectious agent. Attenuation usually made by growing of an infectious organism under abnormal culture conditions. These types of vaccine induce complete type of immune response (both humoral and cellular) and confer higher level and long period of protections than killed vaccine. Live vaccine attenuated ones may revert to full virulence after inoculation in to animal and elicit disease, example PPR, Rinder pest, Lumpy Skin Diseases.

c) Toxoid vaccines are prepared from toxins obtained from microorganism and has been treated by heat or chemical agent to destroy its deleterious properties without destroying its abilities to stimulate the formation of antibody, example tetanus vaccine.

d) Autogenous vaccines are prepared from culture of materials derived from a disease lesion of the animal to be vaccinated, example bovine herpes virus papilloma.

e) Serovaccine is prepared from the combination of antisera and with a vaccine to produce passive and active immunity, example rabies vaccine.

9.2.1. Booster vaccination is given at interval to ensure immunological memory for rapid immune response to pathogens. The time may vary depending on whether the vaccine is killed or living. Therefore for most killed vaccines yearly based revaccination is recommended. Notice that for some exception vaccination should planned for the time prior to the expected disease outbreak that is not always waiting one year to revaccinate the animals (Kahn, 2010).

9.3. Precaution and contraindication of vaccines

The following measurements must be respected to administer vaccines to animals these include: sick animals should not be vaccinated, animals under immunosuppressive drug treatment should not be vaccinated within three to four weeks, care should be taken in the use of antibiotics when a vaccine containing live bacteria administered, the full course vaccination recommended by manufacturer should always be administered, stressing of animals to be vaccinated should be avoided, do not vaccinated via dirt and wet skin, repeated use of needles and syringes within herd/flock undesirable, containers that have held live vaccine can be potentially hazardous and should be kept/dispose safely, injectable vaccine should be stored and reconstituted as recommended by manufacturer, liquid preparation should be adequately shaken before use to ensure uniformity of vaccine to be injected, accidental self-injection with oil based vaccines can cause intense vascular spasm which may result loss of limbs and during mass vaccination of multiple age group with live vaccine, the transmission of infection due to the organisms in the vaccine to be susceptible young animals should be considered.

9.4. Common veterinary vaccines in Ethiopia

The National Veterinary Institute (NVI) at Debre zeit produce most vaccines used in livestock in Ethiopia. Vaccines for pets are mainly imported. The following are veterinary vaccines used in livestock and pets. Table 1: Common veterinary vaccines and their doses in Ethiopia

No.	List of vaccines	Spp of animal	dose	Age of animal to be vaccinated	Booster vaccination/ revaccination	Type of vaccines
1	Anthrax	Bovine	1ml	≥3 month	Every 1 year	Live bacteria
		Equine	1ml	≥3 month	Every 1 year	Live bacteria
		Shoat	0.5ml	≥3 month	Every 1 year	Live bacteria
2	Bovine pasteurellosis	Bovine	2ml	≥1 year	Every 8 month	Killed bacteria
3	Black leg	Bovine	2ml	≥1 year	Every 1 year	Killed bacteria
4	Brucellosis (strain 19)	Bovine	5ml	≥2 month	Every 7 year	Live bacteria
5	Brucellosis(strain 45/20)	Bovine	5ml	≥6 month	Every 7 year	killed bacteria
6	Contagious bovine **pp**	Bovine	1ml	≥6 month	Every 1 year	Live bacteria
7	Contagious Caprine pp	Caprine	1ml	≥6 month	Every 1 year	killed bacteria
8	Ovine pasteurellosis	Ovine	1ml	≥6 month	Every 8 month	Killed bacteria
9	Lumpy skin disease	Bovine	1ml	≥6 month	Every 2 year	Live virus
10	Foot &mouth disease	Bovine	4ml	≥6 month	Every 1 year	Killed virus
		Shoat	2ml	≥6 month	Every 8 month	Killed virus
11	Peste des petitis ruminant PPR	Shoat	1ml	≥6 month	Every 1 year	Live virus
12	Rinder pest	Bovine	1ml	≥6 month	Every 1 year	Live virus

13	Sheep &goat pox	Shoat	1ml	≥6 month	Every 2 year	Live virus
14	African horse sickness	Equine	1ml	≥ 6 month	Every 1 year	Live virus
15	Avian coccidosis	Avian	1ml	≥ 9 days	Every 1 year	
16	Fowl pox	Avian	2ml	≥ 2 month	Every 1 year	Live virus
17	Fowl typhoid	Avian	0.2ml	≥ 6 weeks	Every 3 month	Live virus
18	Marek's	Avian	0.2mg	Day old	At 3 week	Live virus
19	Canine adenovirus	Canine	1ml	≥ 6 weeks	Every 1 year	Live virus
20	Canine distemper	Canine	1ml	≥ 6 weeks	Every 1 year	Live virus
21	Canine parvovirus	Canine	1ml	≥ 2 weeks	Every 1 year	Live virus
22	Rabies	Canine	1ml	≥ 3 month	Every 1 year	killed virus
		Feline	1ml	≥ 3 month	Every 1 year	killed virus
		Bovine	1ml	≥ 6 month	Every 1 year	killed virus
		Equine	1ml	≥ 6 month	Every 1 year	killed virus

Table 1: Common veterinary vaccines and their doses in the country and some of them are not produced in NVI of Ethiopia.

9.5. Newcastle disease (NCD) vaccination

Dosage and administration follows the three method of application such as:

A) **Ocular route**, in this method use eye dropper to calculate volume of water required. Measure 1ml of water in to dropper, and then count the number of drops in this 1ml of water. Calculate the volume of diluents required to dilute the number of doses of the vaccine per vial with the eye dropper in use. **Notice that** one drop is equal to one dose which is given for one chicken. So volume of diluents = No. of doses of vaccine per vial/No. of drops formed per 1ml. For example how much diluents should be added to vial containing 250 doses of NCD vaccine and if that 1ml of water in the eye dropper yielded 50 drops. So volume of diluents = 250 doses per vial / 50 drops per 1ml=5ml per vial required.

B) Oral drench: in this method simply dissolve the 200 doses in 200ml, the 100 doses in 100ml and the 50 doses in 50ml of water. Then administer by oral drench 1ml of dissolved vaccine squirting in to beak of each bird using a clean plastic syringe.

C) Drinking water: this is done based on age of birds. So the quantity of water generally required per bird for drinking water vaccination is grouped as follows. a) for 10-14 days old birds required 10-15ml of water, b) for 3-8 weeks old birds required 20-30ml of water and c) for above 8 weeks old birds required 40ml of water. Example, to calculate the volume of water required to dilute the vaccine, multiply the number of doses of the vaccine per vial by amount of ml required per bird according to the above grouping. Example to dilute 500 doses of vaccine for 8 week old birds, simply multiply 500 doses by 30ml, that means one vial needs 15 liters of water to dilute the 500 doses of vaccine per vial (Kahn, 2010).

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