PART 3 Diseases and their control

This section provides a guide to diseases; their identification, prevention and control.

Reference is made to use of antibiotics and insecticides for the control of some diseases and infestations. In most cases, their use is of questionable value in village flocks. Unless general husbandry is improved, the single use of an antibiotic or insecticide is highly unlikely to significantly increase production in the medium to long term.

The misuse of antibiotics and insecticides can promote increased resistance to these products and reduce their efficacy in the long term. Therefore, if a decision is made to use them, care should be taken to ensure that:

- 1. the most appropriate medicinal substance or insecticide has been selected
- 2. its expiry date has not been passed
- 3. it has been properly stored
- 4. the instructions for its use are followed closely.

Remember that preventing a disease is better and generally cheaper than treating it. Preventing disease in village chickens by the strategic use of vaccination and improved husbandry is usually the most cost-effective approach.

8 Disease in village chickens

8.1 Introduction

Disease in village chickens can be defined as any change or impairment of normal body function that affects the birds' ability to survive, grow or reproduce. Societies have developed many theories about what causes disease in people and animals. Some theories suggest that disease is caused by evil spirits or by witchcraft. In parts of West Africa, for example, some people believe that their chickens die in large numbers just before Christmas because God needs them at this time. Advances in science and medicine have given us a much better understanding of the causes of diseases, which are discussed in Section 8.2.

Respect local ideas and beliefs that explain the occurrence of diseases while also helping farmers to understand how a disease can affect chickens and, in the case of an infectious disease, how it is transmitted.

An understanding of the cause of a disease and its method of spread (transmission) will assist in controlling it. Knowledge of the clinical signs of a disease and the characteristics of lesions found post-mortem will assist in its diagnosis.

8.2 Causes of disease

Many diseases—called infectious diseases—are caused by organisms that can be transmitted from one bird to another. Some of these organisms are too small to be seen without the assistance of special equipment. Such organisms include viruses (ND virus, for example), bacteria (salmonella, for example), mycoplasmas, fungi and small parasites called protozoans (coccidia, for example). Other infectious organisms such as external (lice, fleas and ticks) or internal (roundworms, tapeworms, flukes) parasites are easier to see.

Other diseases can be caused by poor nutrition or husbandry (see Chapter 7), or are inherited. These diseases do not spread from one bird to another and affect only single birds or flocks.

In many cases, disease results from a combination of factors (Figure 22). Husbandry, nutrition, environmental factors and flock management all have a direct and important influence on the health and productivity of chickens. A well-nourished chicken kept under good husbandry conditions can fight diseases better and is less likely to suffer from many infectious diseases.



Figure 22. Factors influencing the health status of chickens (adapted from Woernle and Jodas 2001)

8.3 Transmission of infectious diseases

Diseases that are caused by viruses, bacteria, mycoplasmas, fungi or parasites (infectious diseases) can spread from one bird to another. The ways and mechanisms of this process, called 'transmission', must be understood if the correct measures are to be taken to prevent the spread of such diseases.

Most infectious agents enter via the beak while the chicken is eating, drinking or cleaning its feathers, or during breathing. Other infectious agents can infect a bird through a wound. The agent then multiplies within the chicken and may spread, causing damage (lesions) in certain organs and, consequently, clinical signs. After multiplication, some of the infectious agents leave the bird in its droppings, in discharges from lesions, in its breath, or even on dropped feathers. If other birds come in contact with these contaminated items, then they too may get sick.

Infectious agents can survive outside the bird for variable periods. Worm eggs and coccidia, for example, can survive for several months in the environment

while some other infectious agents are quickly destroyed by sunlight or heat. For spread of diseases caused by agents that are readily destroyed, direct contact between the birds is necessary. On the other hand, infectious agents that can survive for a certain time in the environment can also be spread via any person, animal or material that might carry the agent. The infectious agent might be carried with small traces of droppings on shoes, for example, or in the dust or small feathers attached to any rough surface, on the eggshell or with any part of a dead chicken.

When an infectious agent enters a bird, the bird does not get sick immediately. It usually takes some days for the bird to show signs of illness. This period is called the 'incubation period'. During the incubation period the bird does not look sick but the number of infectious organisms inside it increases rapidly and some organisms may leave the bird when it breathes or drinks or passes droppings (Figure 23). This means that **the agents causing an infectious disease can be spreading even before clinical signs of the disease can be seen.**

Some infectious diseases can also be spread vertically, i.e. from the hen to its offspring, by transmission through eggs. To date, vertically transmitted diseases appear to have been more of a problem in commercial poultry enterprises.

8.4 Notifiable diseases

Some infectious poultry diseases (particularly ND and HPAI) cannot be controlled by good husbandry and flock management alone. These diseases are caused by very strong and contagious viruses and can lead to very high losses in chickens or other poultry species. Because of the huge impact these diseases may have on poultry production and trade, they are notifiable all over the world, i.e. they are World Organisation for Animal Health (OIE) 'transboundary animal diseases'. Outbreaks must be reported to, and control measures coordinated by, the veterinary authorities.

8.5 Diagnosis of poultry disease

Since several factors may cause a disease or contribute to it, it is important to conduct a thorough investigation. This will assist you to make an accurate diagnosis, to understand why the birds got sick and to take appropriate control measures.

Examination of the sick chicken, the case history and an examination of the whole flock and its environment are important parts of the investigation. These provide the information needed to understand the course of any disease. Each of these is discussed in this chapter.



Figure 23. It takes 2–15 days from the time they come into contact with the Newcastle disease (ND) virus for birds to show signs of illness.

8.5.1 Case history

The case history will give information about the course of the disease (the number of birds affected, and the severity and duration of the disease), the means of introduction into the flock and whether or not the disease is infectious.

The person looking after the chickens should be asked the following questions since they generally have a better understanding of what is going on in the flock than the head of the household.

The farmer's observations of their chickens:

- Why do you think the chickens are sick? Describe the signs observed.
- What age groups are affected by the disease (chicks, growers, adults)?
- When did your chickens become sick?

The severity and nature of the disease:

- How many chickens do you have? How many of them are sick?
- Did any of your chickens die? OR Have any chickens been slaughtered recently because they were sick? If yes: how many?
- Do you have other birds besides chickens? Are they sick too?

Husbandry factors:

- Do you provide feed and water for your chickens?
- If yes: how often do you provide them with fresh feed and water? What do you feed your chickens with and how much do you give them?
- Where do you keep the chickens at night?
- If you provide housing for your chickens, how often do you clean the shelter?
- Did you use any traditional remedies or drugs in your chickens?
- Have the birds been vaccinated? When? What vaccine was used?

How the disease might have entered the flock:

- Do birds in neighbouring flocks show the same signs? If yes, how many flocks are affected?
- Did you bring new birds to your household recently?
- Did you recently visit someone whose chickens were sick? OR Has someone whose chickens are sick recently visited your homestead?

8.5.2 Clinical examination of the whole flock and its environment

This examination will provide information on the health status of the flock and confirm the information provided by the person looking after the chickens. Since chickens in poor condition are more likely to get sick from any infectious agent, an assessment of housing and nutrition is also important.

Examination of the whole flock:

- Are the chickens active?
- Do they scavenge for their feed?
- Is feed and water provided? If so, is the feed fresh or old and/or mouldy?
- · How many of the chickens are sick?
- · Which age groups are affected by the disease?
- · What does the plumage (feathers) look like?
- What do the droppings look like?
- Are the hens laying eggs as normal?
- What do the eggs look like?

Examination of the environment:

- If the farmer provides housing:
 - Where and how are the chickens kept at night?
 - Is the shelter clean?
 - Is the shelter crowded at night?
- If the farmer provides feed/water:
 - What is the quality of the feed or water provided?
 - Is the drinker or feed trough clean?
- Do the chickens find feed and water in the surroundings of the homestead?
- Are there many droppings close to the chicken house, waterer or feed trough?

8.5.3 Clinical examination of sick birds

To examine a sick chicken you will have to catch and hold it in your hands (Figure 24). If there is a possibility that the chicken is infected with HPAI or any other disease that can also infect humans, then appropriate safety measures should be used (see Section 11.2). A hook made of wire might help you to catch chickens (Figure 25). The design of the hook is important and will depend on the age and size of the birds. It is important that the hook is used in a way that does not injure the bird (Figure 26).



Figure 24. Birds should be handled correctly to minimise stress. Do not hold birds by their legs only (a). Rather, use two hands to hold both the legs and support the bird's neck (b).



Figure 25. Design of a wire hook for catching chickens



Figure 26. Correct use of a wire hook to catch a chicken

Examine the bird thoroughly for the following signs:

General signs

- Is the bird active or sleepy?
- Are the feathers smooth, clean and free of external parasites?
- Is the bird well nourished? (Feel the breast muscle of the bird: birds that have been sick for a long time lose body weight and have a thin breast muscle. Feel the muscle of other birds for comparison.)
- Has the bird eaten within the last few hours? Feel the crop to confirm.

Respiratory signs

- Is the bird breathing through an open beak?
- Is the breathing noisy?
- Is the bird coughing or sneezing?
- Are there swellings around the eyes and discharge from the eyes, nose or beak? If present, nasal discharge can be squeezed out by pressing gently above the nostrils.

Diarrhoea

• Are the feathers around the vent dirty? The feathers will be dirty when the bird has diarrhoea.

Nervous signs

• Does the bird show any nervous signs (e.g. twisted neck, trembling)?

Movement

- Is the bird lame?
- Are the joints swollen?
- Are the legs and wings in a normal position?

Skin and feathers

- Are there external parasites on the feathers and on body regions with few feathers (head, under the wings, above the vent)?
- Are there injuries or lesions on the bird's skin, especially on the head, comb and wattles?
- Are the feathers damaged?
- Are there changes in colour (pale, dark, bluish) or size of the comb or wattles?

Table 12 (see also Table 15 in Chapter 10) indicates that several diseases of village chickens may cause similar clinical signs. In most cases, clinical examination and the case history provide information that allows a clinical diagnosis to be made, but do not reveal the definitive cause of the disease. A particular cause (e.g. coccidiosis if bloody diarrhoea in younger chicks has been observed) may be suspected but a proper clinical diagnosis has to concentrate on actual facts (e.g. 'bloody diarrhoea, suspected coccidiosis').

This manual therefore concentrates on the identification of clinical signs and describes how a clinical diagnosis may be reached. Chapter 9 provides general information on prevention and control of infectious diseases. A detailed description of individual diseases is then given in Chapters 10 and 11. The diseases in Chapter 11 are listed in alphabetical order to make it easier to locate them.

Appendixes 3–5 provide information on post-mortems, sample collection and serology for those who have the equipment to perform these procedures.

	Clinical signs	Possible reasons
General	Depression, listlessness, inappetence, drooping wings, low productivity	Wide range of causes
	Emaciation	Chronic, long-lasting disease
Respiratory system—breathing	With open beak	Newcastle disease (ND), infectious laryngotracheitis Other severe respiratory disease Very hot weather
	Distressed, noisy, rattling	ND, highly pathogenic avian influenza (HPAI), severe respiratory disease
	Coughing, sneezing, wheezing, gurgling	Infectious coryza, infectious bronchitis (IB), chronic respiratory disease (CRD), other respiratory disease Fowl cholera
Respiratory system—nostrils	Wet or crusted because of nasal discharge	Infectious coryza, CRD, other respiratory disease
Eyes	Swelling around the eyes	Infectious coryza, CRD, other respiratory disease ND, fowl cholera
	Discharge	Infectious coryza, CRD, other respiratory disease Fowl cholera
	Cloudy pupils	Various reasons
Alimentary system	Dirty vent	Coccidia, worms, spirochaete infection ND, infectious bursal disease IBD/Gumboro disease Fowl typhoid, pullorum disease, fowl cholera, colisepticaemia or other infectious disease

Table 12. Clinical signs that may be present in sick chickens and possible reasons for their occurrence

Table 12.(continued)

	Clinical signs	Possible reasons
Nervous system	Twisted neck (torticollis)	ND, HPAI or any other disease affecting the nervous system
	Lameness (paralysis)	ND or any other disease affecting the nervous system
	Trembling, shaking	ND or any other disease affecting the nervous system
Musculoskeletal system	Lameness	Crusted legs due to scaly leg mites Marek's disease Other reasons
	Swollen joints	Fowl cholera Various other reasons
	Abnormal position of legs	Marek's disease Nutritional deficiencies Any accident Various other diseases
	Swellings under the feet	Infected injuries
Feathers	Small spots, maybe moving	External parasites—lice or mites
	Moulting	Usual moulting process (once a year) Under stress
	Ruffled	General sign indicating that a chicken is sick
	Lesions, damage	Lice Feather pecking or cannibalism
Skin	Pale skin	IBD/Gumboro Severe infestation with external parasites, especially the red fowl mite
	Dark, bluish (bruising)	HPAI, ND, aspergillosis, IBD/ Gumboro
Skin—comb	Yellowish to dark-brown crusty spots	Fowl pox
	Pale	Chronic diseases Severe infestation with parasites
	Dark, bluish	Acute feverish diseases affecting the circulatory system (e.g. fowl cholera, HPAI, ND)
Skin-wattle	Yellowish to dark-brown lesions	Fowl pox
	Dark, bluish	Acute febrile diseases affecting the circulatory system (e.g. fowl cholera, HPAI)
	Swollen	Fowl cholera, HPAI, ND
Inside the beak	Yellow–white cheesy-looking lesions	Fowl pox

9 Disease control

9.1 Introduction

To keep chickens in good health and support high productivity it is necessary to control the diseases affecting the birds. Effective disease control includes measures taken to cure or eradicate a disease as well as measures designed to prevent it.

What should be the aim: eradication or control?

It is not always possible to eradicate the cause of an infectious disease, especially if wild birds also carry the infectious agent or if the infectious agent is very widespread (endemic). However, it is possible and desirable to control the clinical diseases caused by many infectious agents. For example, ND virus is endemic in many regions and is therefore almost impossible to eradicate. Nevertheless, the clinical signs of ND can be avoided by regular vaccination and good biosecurity.

9.2 Tools used to control diseases in village chickens

The following are among the measures required to ensure comprehensive disease control.

9.2.1 General measures

Husbandry, nutrition, flock management and environmental factors have a direct and important influence on flock health (discussed in Chapter 8). Improvements in these areas should generally be part of the control of any disease (see Part 2—Housing, nutrition and management).

9.2.2 Hygiene (biosecurity)

Procedures described in the **sanitary rules** (see Section 9.3) will help to prevent the entry and spread of infectious diseases and contribute to improved flock productivity and production of better-quality eggs and meat.

9.2.3 Traditional remedies

In many countries, farmers use traditional remedies to treat diseases of village chickens. Some of the remedies may be effective, and others less effective or even harmful. This manual does not deal with the large range of traditional remedies that are used. However, local extension officers should identify and test remedies used in the areas where they work.

No known cure for ND or HPAI

There is no known cure (traditional or otherwise) for diseases such as ND and HPAI. The best way to control ND is through prevention, the most important aspect of which is vaccination.

9.2.4 Vaccination

Vaccines can protect animals from infectious diseases but **they cannot treat a disease**. Moreover, vaccines are disease-specific and protect animals against only a specific disease rather than all diseases. Vaccines work best on healthy, well-fed animals that are not suffering from parasites or other diseases. **Do not vaccinate weak or sick birds.** If a bird is already **incubating ND or another killer disease, the chicken will die and farmers may be angry or discouraged, and lose confidence in the vaccine.**

Commercial vaccines (produced by large pharmaceutical companies) can prevent many diseases in poultry. Nevertheless, their use is often not practical under village conditions because many require continuous refrigeration (referred to as 'a constant cool chain') and are delivered in packages containing a large number of doses beyond the needs for small, village flocks. In addition, some diseases, such as infectious bursal disease (IBD; also known as Gumboro disease), that are of concern for commercial poultry units are of little or no economic importance under free-range conditions.

Vaccine specificity

Farmers must understand that vaccination with a particular vaccine protects their chickens against only a specific disease and that their chickens might suffer from other diseases despite successful vaccination. An example can be used to explain this: children vaccinated against polio or measles might still get malaria.

9.2.5 Commercial medicines and insecticides

A variety of products (e.g. antibiotics, insecticides and anthelmintics) might be available in local supply shops for treatment of poultry diseases. If you intend to use them, ensure that the labels on the materials available indicate that they are formulated for the treatment of the particular diseases. Always follow the instructions on dosage and method of application given on the label or information leaflet.

 To calculate the correct dose, be aware that sick chickens might feed and drink less than normal. Four to five healthy chickens drink 1 litre of water per day.

- Drugs that have to be administered via the drinking water might lose their potency if added to dirty water. Clean the trough thoroughly and use fresh, non-chlorinated water to administer drugs.
- The use of most insecticides requires special safety precautions, which are given on the instruction leaflet.

REMEMBER: Medicines alone will not eradicate a disease. Clean the chicken house and remove infectious material as described in this manual. Always make sure that enough fresh water, feed and proper housing are available for sick birds to help them recover from a disease.

9.3 How to prevent a disease entering a village chicken flock

Farmers should obey the following sanitary (biosecurity) rules, which together are a cheap and a very effective way to prevent infectious diseases.

- Clean the chicken house, troughs and nests regularly.
- Provide separate night housing for the different poultry species.
- Encourage separation between animal species and between animals and humans; waterfowl should be separated from chickens and turkeys.
- Regularly clean out and dispose of manure, and preferably compost it for at least 3 weeks.
- Dispose of sick and dead animals and infected materials correctly, and clean and disinfect/decontaminate thoroughly (see below).
- Avoid introducing new birds of unknown origin or from a sick flock into the 'home' flock.
- Always scrub cages, egg trays etc. with disinfectant or detergent and allow to dry before bringing them onto the farm. Farmers should be reminded that manure, dirt, feathers etc. will stop the disinfectant working properly. If they do not have any disinfectant, they should put the items in a sealed, black plastic bag in direct sunlight for 1 day so that the high temperature inside can inactivate disease agents.
- Keep new birds separate from the flock for 2 weeks to see if they become sick.
- Avoid contact of the 'home' flock with visitors, cages or animals from an area where there is a disease outbreak in poultry.
- Wash hands with soap after handling birds from other flocks.
- Vaccinate against specific diseases, which is possible but not always practical under village conditions (see previous section). Regular vaccination against ND is the only effective way to control this disease.

- Well-nourished birds can better fight disease. If possible and where necessary, farmers should provide their chickens with supplementary feed (Section 5.6) to prevent diseases caused by nutritional deficiencies and to promote good health.
- Chickens should not be bought from the markets or neighbouring villages at times of the year when outbreaks of disease such as ND are more common (Figure 27).
- Slaughter only healthy birds from healthy flocks for consumption. Immerse the bird in boiling water for a minute before plucking the feathers. This will make the feathers easier to remove and inactivate any infectious agents on the outside of the bird.
- In villages where birds are dying of disease, no birds should be slaughtered for consumption.



Figure 27. Do not introduce new birds to flocks during outbreaks of disease.

9.4 How to control a disease outbreak in a village chicken flock

If they detect illness in one or more of their flock, farmers should take the following steps to control the spread of the disease.

- They should separate chickens showing signs of illness from healthy birds (Figure 28). Sick chickens could be placed in a separate chicken house or cage. Always ensure that water and feed are available nearby should they wish to drink or eat. Similarly, place new stock into a cage or pen that isolates them from the main flock for at least 2 weeks, to ensure that they are not carrying any diseases that could be transmitted to the flock.
- They should not take sick chickens to another area that is free of the disease.
- They should slaughter very sick chickens. This is the best approach to take under such circumstances.
- They should burn or bury dead chickens or the remains of a slaughtered sick bird immediately. If, for any reason, the whole bird cannot be burnt or buried, then all parts of the bird (e.g. bones, feathers etc.) that remain should be burnt or buried (Figure 29).
- If high losses occur in their flock, they should inform their local livestock services.
- They should clean their chicken house frequently and thoroughly. Droppings should be removed as often as possible to avoid further spread of the disease. Wood ash or lime should be places on the floor and walls.
- They should not introduce new birds into the 'home' flock if they suspect that the chickens in the 'home' flock are suffering from an infectious disease. Newly introduced birds may also become infected with the disease.
- If high losses occur in a chicken flock, the farmer's best approach is to slaughter all birds and wait for some time before restocking. For example, if birds have died from ND, farmers should wait 30 days after the last bird died before introducing new birds. ND virus should be inactivated after 30 days in most tropical conditions but it can survive for up to 6 months in cool, damp locations. The minimum interval before restocking after an outbreak of HPAI is 21 days, provided that the poultry premises have been thoroughly cleaned and disinfected at least twice during this period. Under most village conditions, however, it is advisable to wait 45–60 days.
- If high losses occur in the flock it is best to burn the chicken house and build a new one in a different location. Manure from the sick flock should also be buried in order to avoid further spread of disease.



Figure 28. Sick chickens should be separated from healthy chickens.



Figure 29. Birds killed by disease, or their remains, should be buried (or burned) to stop the disease spreading to new areas (a). Burial pits should be at least 1 m deep (b) if possible and well away from water sources such as wells and rivers. Hands should be washed and clothes washed or boiled after dead birds are handled.

10 Newcastle disease

10.1 Cause and impact

One of the major constraints to village chicken production is ND. In many countries, outbreaks of this disease regularly kill 50–100% of susceptible chickens. In countries where ND is common, outbreaks can occur once or twice a year. The fact that ND has a local name in many countries indicates the importance of this disease.

Newcastle disease is caused by a paramyxovirus that occurs in a range of types (or strains) of widely variable strength (virulence). Sometimes, the strain of virus present will cause very few deaths in chickens; at other times, the virus strain involved may cause many deaths. For example, if a farmer has 10 chickens, then infection with a:

weak ND virus may cause (i.e. lentogenic ND virus)	death of 1 of the 10 chickens
moderately strong ND virus may cause (i.e. mesogenic ND virus)	death of 5 of the 10 chickens
very strong ND virus may cause (i.e. velogenic ND virus)	death of all 10 chickens

10.2 Transmission

Newcastle disease is very contagious. This means that the disease can spread from one chicken to another very easily. The ND virus is passed in the bird's droppings, breath and any discharge from its eyes or nose.

Although the ND virus can be destroyed (inactivated) quickly at temperatures above 8 °C (i.e. the virus is 'thermolabile'), it might survive for several months inside clumps of bird droppings.

Figure 30 illustrates some ways that ND virus can be spread (transmitted) from bird to bird:

- The droppings of a bird with ND can spread the virus.
- Dogs or predators can spread the virus by carrying a chicken carcass infected with ND to a different location and by distributing the uneaten parts (e.g. feathers and bones).
- If eggs come from or have contact with a chicken sick with ND, then the ND virus can contaminate the shell and be carried on the outside of the egg. Vertical transmission (spread from the mother hen to her chicks through the embryo) of ND virus has not been proven.
- Cars or other vehicles passing through an area where an ND outbreak is occurring could carry the ND virus to other areas on their tyres.
- Chicken organs, bones, intestines, feathers, feet or other parts or products from a sick chicken that have not been cooked can all carry the ND virus.
- People can carry the virus from one flock to another on their shoes or clothes.

Furthermore, the ND virus can be transmitted by:

- · direct contact between infected birds
- · inhalation of contaminated air by uninfected chickens
- · intake of contaminated feed or water
- · contact with infected wild birds
- contaminated chicken houses
- · contaminated baskets, cages, hoes or other equipment.

The role of humans in the spread of Newcastle disease (ND)

In areas where the movement of birds is not controlled, farmers often sell some of their birds before and/or during ND outbreaks. Birds that have come into contact with the ND virus can spread it to other birds in the market. So it is possible that healthy-looking birds purchased at the market could develop ND when taken home. People working in villages (e.g. farmers, vaccinators, traders, extension workers etc.) may also spread the disease by carrying ND virus on their shoes and equipment from households with sick birds to other households.



Figure 30. The Newcastle disease virus can be spread in many different ways through contact with infected animals and animal parts, and mechanical transmission of the virus via people and vehicles.

10.3 Species affected

As well as chickens, domestic poultry such as turkeys, guineafowl and pigeons may be affected by ND. Ducks are usually resistant to the disease but, on occasions, ducklings may be affected. Wild birds can also carry the ND virus.

10.4 Clinical signs

After contact with the ND virus, it usually takes 3–5 days for unprotected birds to show signs of illness. Sometimes, however, illness may occur within 2 days, and at other times it may take up to 15 days for clinical signs to appear.

The clinical signs of ND vary considerably according to the type (virulence and tropism) of the ND virus involved, the species, age and immune status of the bird, and environmental conditions. As a result, there are no clinical signs that are unique to ND (i.e. there are no pathognomonic signs). Indeed, chickens infected with virulent (strong) ND virus strains may die before any signs of illness are seen.

Signs of illness may include one or more of the following:

• The chicken fluffs its feathers and appears to 'have its coat dragging on the ground' (Figure 31).



Figure 31. Farmers in many parts of the world have observed that a chicken with Newcastle disease 'has its coat dragging on the ground'.

- The chicken looks sleepy (lethargy) and does not eat (inappetence).
- The chicken has slight difficulty breathing (respiratory signs such as mild rales and snick can be detected by careful observation).
- There is severe respiratory distress and gasping.
- The head and neck are swollen.
- There is greenish diarrhoea.

- Egg production decreases markedly. Sometimes deformed eggs are produced.
- When the disease is advanced, nervous signs such as shaking (tremor), torticollis (twisted neck), convulsions and paralysis of the wings and legs may be seen (Figure 32).



Figure 32. Torticollis is generally seen in chickens only when Newcastle disease is at an advanced stage.

• Mortality may be very high, often reaching 50–100% (Figure 33).



Figure 33. Newcastle disease or highly pathogenic avian influenza virus should be suspected when mortality of 50–100% is observed in a flock of chickens.

10.5 Post-mortem findings

Post-mortem findings are characteristic but not definitive (i.e. not pathognomonic). Newcastle disease should be suspected if the following lesions are encountered, particularly if they occur in combination (and when the flock history is also consistent with ND):

- reddening (congestion) and clear watery fluid (mucous exudates) in the trachea
- congestion of the lungs (lungs are heavier than normal and sink in water/formalin)
- · haemorrhages of the mucosa of the proventriculus
- haemorrhagic and necrotic ulceration of lymphoid patches of the intestine, caecal tonsils and bursa of Fabricius
- congested ovarian follicles in hens in lay.

10.6 Field diagnosis of Newcastle disease

Accurate field diagnosis of ND in village chickens is often difficult, but when it is achieved it will assist in determining the prevalence of ND in the area concerned.

Case definition

In regions where the disease is endemic (and highly pathogenic avian influenza is not present) and where a laboratory confirmation of Newcastle disease (ND) is not possible, **an outbreak of ND should be suspected when there is high mortality in three or more neighbouring chicken flocks.**

To assist with diagnosis, it is best to separate cases according to the level of mortality observed:

- High mortality in flocks not vaccinated against ND. When 50–100% of birds in a flock die with the clinical signs listed above, it is likely that the deaths were caused by virulent ND. Highly pathogenic avian influenza can also cause high mortality but HPAI is currently endemic in a few limited areas whereas ND is endemic in many countries worldwide.
- High mortality in birds vaccinated against ND. This circumstance requires detailed and rapid investigation. It must be determined if:
 - 1) vaccination against ND was unsuccessful and, if so, why

OR

- 2) the birds have been infected with HPAI.
- Low mortality. In circumstances of low mortality it is more difficult to diagnose the disease involved. In areas where the majority of chickens are vaccinated against ND or have survived a natural outbreak of the disease,

infection with virulent ND virus will provoke mortality only in those chickens that are not immune. In this case, it is necessary to distinguish ND from other diseases that cause mortalities (such as IBD/Gumboro, fowl cholera and fowl pox). Unfortunately, there are no pathognomonic clinical signs or post-mortem lesions. When field diagnosis is not easy, it is always best to confirm the diagnosis by submitting the appropriate samples to a veterinary diagnostic laboratory.

10.7 Investigating vaccination failure

After chickens have been vaccinated, the extension worker or livestock officer may receive reports of illness or death in vaccinated birds. In most cases, the farmers will blame the vaccine and, unless such reports are investigated thoroughly and the reasons for the apparent failure of vaccination are established and discussed with the farmers, the success of future vaccination campaigns may be at risk.

Vaccination failure occurs when the chickens do not develop adequate antibody titres following vaccination and/or are susceptible to field disease. Many factors may be responsible for the apparent failure of the vaccine to protect the chickens: some are related to the vaccine, others to the way the vaccine was handled and administered, while others are associated with the chicken itself.

To help work out the cause of the apparent vaccination failure, ask the farmer or vaccinator to describe the problem. The following questions can be posed:

- · How many birds are sick or have died?
- What signs did they show?
- Are any birds still sick? (examine them if possible)
- Are any of the neighbours' chickens sick?
- What vaccine was used? (Does the farmer still have the vaccine bottle?)

If the farmer's chickens were vaccinated using ND vaccine and show signs of another disease, for example fowl pox, then it is most likely that the vaccine is not responsible for the disease. Once ND has been controlled in a flock, other diseases may become more apparent.

If the farmer's chickens were vaccinated using ND vaccine and show signs of ND, then further investigation is necessary. Ask the farmer:

- What vaccine was used? (Does the farmer still have the vaccine bottle?)
- When were the birds vaccinated?
- When did the chickens get sick?
- Were all the birds in the flock vaccinated?
- How was the vaccine given to the chickens?
- How was the vaccine stored?

If the farmer or vaccinator still has the vaccine bottle, read the label and record the name of the vaccine, its batch number and expiry date, and note any information about how it should be given. If the vaccine was given by dropper, ask the farmer if they still have the dropper.

Have you seen or used this vaccine previously? In some countries, counterfeit vaccines may be on the market and, if used, will not protect the chickens. Their sale should be reported to the authorities.

If the vaccine is one you have encountered before, was it used within the expiry date? Vaccine used after it has expired cannot be relied on to protect chickens.

If the vaccine is one you have encountered before and it was used within the expiry date, was the vaccine correctly conserved before it was used? How was it stored? Most vaccines require a good cold chain to retain their activity. Only thermotolerant vaccines such as NDV4-HR and I-2 ND vaccines will withstand short periods outside a cold chain.

If the vaccine was given to the chickens by any route other than that recommended by the manufacturer, or a diluent other than that recommended by the manufacturer was used, it is likely that the bird will not develop the expected long-lasting level of immunity.

If the vaccine was given to the chickens using a dropper or by any means other than that recommended by the manufacturer, check the number of drops delivered by the dropper (or return the dropper to the manufacturer for testing). If the chicken has not received an adequate dose of vaccine, it is likely that it will not develop the expected long-lasting level of immunity.

If the chickens became sick within 7 days of vaccination and other birds in the village are showing signs of ND, then it is most likely that the chickens were incubating ND at the time of vaccination and the vaccine cannot be expected to be effective.

If it is more than 4 months since the chickens were vaccinated and they are showing signs of ND, then it is most likely that their level of immunity has decreased and revaccination is necessary.

Finally, birds that are stressed, malnourished, immunosuppressed due to diseases such as IBD/Gumboro or Marek's disease, or have severe parasitic infections, are unlikely to develop good immunity following vaccination.

10.8 Controlling Newcastle disease

There is no known cure for ND and it cannot be controlled in villages without vaccination. Vaccination should be accompanied by good hygiene (keeping sanitary rules) and other general measures as described in Section 9.3.

Newcastle disease control combined with improved husbandry is often the most cost-effective means of improving village chicken production.

10.8.1 Newcastle disease vaccination

Several different vaccines have been developed to prevent ND (Table 13). This manual deals mainly with a vaccine called I-2, which was specially developed to cope with situations where it is difficult to store and keep vaccines cold.

Note:

The example given below to explain how a vaccine works should be understood in most areas and by people who have limited scientific knowledge about how disease occurs. If you think that the story below may not be well received in a certain area, then please prepare an alternative explanation before the training session.

Giving a vaccine to a bird is like training soldiers to defend an area. The chicken can be thought of as the land to be protected, the vaccine contains the soldiers and the ND particle (virus) is the enemy. The soldiers first have to practise how to fight and to learn about the enemy so that they can win the battle. When soldiers arrive in a new area that needs to be protected, they must establish their lines of defence and collect information about the enemy that is causing problems.

When we give the vaccine to the bird, the bird's defence system is trained to recognise the ND virus as an enemy and establishes lines of defence against it. It takes around 7–14 days for the chicken to develop these lines of defence. The next time that the bird encounters the strong virus, the defence lines are already in place and so the strong virus cannot take over the bird's body. The headquarters for the soldiers lies just behind the chicken's eye and so when the vaccine is given by eye-drop, most of it goes straight to this centre. This is why eye-drop administration causes so strong a protective response.

Vaccine	Thermotolerance	Туре	Source	Administration	Period of protection
I-2	Thermotolerant	Live	Locally produced or imported	Eye-drop, water supply	4 months
NDV4-HR	Thermotolerant	Live	Imported	Eye-drop, water supply	4 months
La Sota	Thermolabile	Live	Imported	Eye-drop, water supply	4 months
Hitchner B1	Thermolabile	Live	Imported	Eye-drop, water supply	4 months
ITA-NEW	Thermotolerant	Inactivated	Imported	Injection	6–12 months

Table 13. Comparison of Newcastle disease vaccine types

When soldiers stay in one place without seeing the enemy for a long time they may get lazy and think that the enemy is not going to attack. If the soldiers forget to maintain their lines of defence, then the enemy could attack and defeat the soldiers. It is the same with vaccine. If we do not re-vaccinate birds every 4 months, the birds' lines of defence against ND will get lazy and will be unable to fight the strong virus successfully.

- Thermolabile vaccines. Thermolabile vaccines are very temperaturedependent and should be used within a short time of being removed from the refrigerator. They will be ineffective if left outside of the refrigerator for longer than the time recommended by the manufacturer.
- Thermotolerant vaccines. Thermotolerant vaccines are more tolerant to higher temperatures and can remain active outside of the refrigerator for longer periods. However, thermotolerant vaccines should still be handled with care and kept as cool as possible.
- **Type.** Live vaccines result in a wider range of immune responses in the bird than do inactivated vaccines, which is an advantage. However, live vaccines stimulate a shorter period of immunity.
- Source. Locally produced vaccines are made to suit local conditions and the revenue from their sale stays within the country.
- Administration. Injectable vaccines are more expensive to administer than vaccines delivered by eye-drop or via the chickens' water supply, since they require skilled and experienced operators. (There is also the risk of needle-stick injuries to humans, which is exacerbated in conditions where blood-borne diseases such as HIV/AIDS are prevalent.)
- Period of protection. Inactivated ND vaccines (e.g. ITA-NEW) provide a longer-lasting protection than the other vaccines. However, in a village environment, chicks are constantly hatching throughout the year. Under these circumstances it is better to administer the vaccine more regularly to adequately cover newly hatched birds. The 4-month protection period provided by live vaccines is therefore suitable for village chickens as flocks should be vaccinated at least three times per year. This is particularly so where ND outbreaks are not restricted to a certain season.

10.8.2 Storing and transporting the I-2 vaccine

The length of time that the I-2 vaccine can be stored inside or outside a refrigerator will vary from country to country according to the method used to prepare and transport the vaccine (e.g. Table 14). The leaflet provided with the vaccine will give recommendations for storage times and conditions. When you obtain a container (it might be a vial or an eye-dropper) of vaccine, always read the label. It is important to know how to store the vaccine and how long it can stay effective outside the refrigerator before and after the container is opened.

Here are some general points for guidance:

- I-2 ND vaccine can keep its activity even if it stays outside the refrigerator for some time, but it must not be exposed to sunlight or allowed to get hot!
- Do NOT freeze the vaccine or put it into areas where ice forms. The vaccine does not tolerate very cold conditions.
- Try to keep vaccine at a constant temperature. The vaccine will lose some of its activity with each change in temperature. When you store the vaccine in a refrigerator, do not place it in the door since it will be exposed to changes in temperature every time the refrigerator is opened.
- If the vaccine is placed in a reliable refrigerator (4–8 °C), it will last until the expiry date on its label. However, once the vaccine has been removed from the refrigerator and allowed to warm, it will lose its activity before the expiry date.
- Transport the vaccine in the field using a cool box and ice pack if they are available. If they are not available, wrap the vial in a damp cloth and carry it in a covered, open-weave basket or any other container that allows the air to pass through in order to keep the vaccine cool and away from sunlight (Figure 34). An open-weave basket and a damp cloth will keep the vaccine cooler than a cool box without ice packs.
- Once the vial has been opened, it will last longer if it is kept cool (around 22 °C) but it should be used as quickly as possible.

Table 14. Storage guidelines prepared using thermostability trial data and provided to users of I-2 vaccine in Mozambique

Storage temperature	Safe storage interval		
	Freeze-dried vaccine	Wet vaccine	
9–30 °C	2 months	2 weeks	
Above 30 °C	2 weeks	2 days	

 Outside a refrigerator, the unopened vaccine will last for 2 weeks as a 'wet' vaccine and 2 months in freeze-dried form if stored in a cool (around 22 °C or less), dark place. In villages, consider placing the vaccine container near the base of a clay water pot that is kept in a clean, dark place. The vaccine should also be stored in a way that prevents children from playing with it. If the unopened vaccine is allowed to get hot (above 30 °C), it will last for only 2 days in the wet form and 2 weeks in the freeze-dried form.



Figure 34. A covered, open-weave basket with a damp cloth inside is a good way to transport thermotolerant vaccine in the field.

10.8.3 Vaccinating chickens

Vaccinating chickens in a regular and effective manner is a complex activity that requires high-quality training and monitoring. Details of these activities can be found in the companion manual 'Controlling Newcastle disease in village chickens: a training manual' (Alders et al. 2002).

Method of administration

It is recommended that I-2 vaccine be given by eye-drop, as the bird develops a stronger immunity when the vaccine enters via the eye. The vaccine can also be given via drinking water but birds then develop a weaker immune response. The vaccine must also be given more often if administered via drinking water and this makes vaccination more expensive. An additional problem is that the more aggressive birds may drink more water, resulting in the weaker birds receiving an inadequate dose of vaccine.

Some notes on eye-drop administration of vaccine follow:

- 1. Eye-drop vaccination is easier if at least two people (such as the farmer and the vaccinator), participate; one person can hold the chickens while the other vaccinates.
- Check each chicken before vaccination to confirm that it is healthy. Sick chickens should not be vaccinated, as they will have a weaker immune response to the vaccine and so may still develop ND during an outbreak.
- 3. Birds should be out of direct sunlight when they are vaccinated (e.g. in the shade of a tree).
- 4. The dropper containing the vaccine should be held vertically above the chicken's eye.
- 5. Place one drop in the eye of the chicken (Figure 35). Do not touch the bird's eye with the tip of the dropper; a contaminated tip may transmit disease.
- 6. All healthy birds in a flock should be vaccinated (even newly hatched chicks).
- 7. To minimise the risk of spreading disease, wash your hands after visiting each flock and avoid walking in chicken droppings.



Figure 35. When using an eye-dropper to administer Newcastle disease vaccine, hold it in a vertical position. Do not touch the eye with the tip of the dropper.

10.9 Reporting Newcastle disease

Newcastle disease is one of the most devastating diseases of chickens, and a combination of strict sanitary measures and vaccination is required to control it. Control measures for diseases such as ND are generally laid down in national control strategies and, because of their economic importance, the diseases are **notifiable**; that is, **every outbreak of ND must be reported to the local veterinary authorities** who will report it to the appropriate national and international authorities.

To ensure accurate reporting, the diagnosis of ND has to be as reliable as possible. Ideally, isolation and characterisation of ND virus should be performed at every primary outbreak. However, this is not practical under village conditions and a case definition has been formulated for ND (see Section 10.6). All cases that meet this definition should be considered as possible outbreaks of ND and followed up by further diagnostic procedures as described in Section 8.5.

10.10 Differential diagnosis of Newcastle disease in village chickens

Newcastle disease can produce a range of signs in chickens, depending on the body system or organs affected. It therefore has to be distinguished from other diseases that affect the same body system or organs (see Table 12) and cause similar clinical signs or high mortality in chickens.

To assist extension workers in the diagnosis and differential diagnosis of ND at village level, Table 15 summarises common diseases of village chickens according to the body system or organ and age group affected.

Body system	Age group	Disease	
Respiratory system	All age groups	Newcastle disease (ND) ^A Chronic respiratory disease ^B Infectious coryza ^B Mycoplasmosis ^B Infectious bronchitis ^A Highly pathogenic avian influenza (HPAI) ^A	
	Chicks	Aspergillosis ^c	
	Growers, adults	Laryngotracheitis ^a Fowl cholera ^B (chronic form)	
Digestive system	All age groups	ND ^A HPAI ^A Colisepticemia ^B Infestation with helminths (usually more of a clinical problem in young birds) ^D	
	Chicks	Pullorum disease ^B Infectious bursal disease/Gumboro ^A Coccidiosis ^D	
	Growers	Fowl typhoid ^B Coccidiosis ^D	
	Adults	Fowl typhoid ^B	
Central nervous system	All age groups	ND ^a HPAI ^a	
	Chicks	Vitamin E deficiency ^E	
	Growers, adults	Marek's disease ^A	
Skin	All age groups	Fowl cholera ^B Infestation with external parasites ^D	
	Growers, adults	Fowl pox ^A	
Urogenital system	All age groups	Infectious bronchitis ^A	
Musculoskeletal system	All age groups	Infectious synovitis ^B (mycoplasmosis) Fowl cholera ^B (chronic form)	
	Chicks	Riboflavin (vitamin B) deficiency ^E Vitamin E deficiency ^E Vitamin D3 deficiency (rickets) ^E	
	Growers	Marek's disease ^A	
	Adults	Marek's disease ^A Avian tuberculosis ^B	
Eggs	Hens	ND ^A Infectious bronchitis ^A HPAI ^A	

Table 15. Differential diagnosis of common diseases of village chickens

^A Viral infection (cannot be treated)

^B Bacterial infection (can be treated using effective antibiotics)

^c Fungal infection (treatment possible but seldom successful)

^D Caused by parasites (can be treated using effective antiparasitic drugs)

^E Nutritional deficiency (can be treated by improving diet)

11 Other infectious diseases of village chickens

11.1 Introduction

Once ND is under control, other diseases that previously had little impact on the village chicken population will probably become more prominent. It is thought that the periodic severe outbreaks of ND that wipe out the whole flock also wipe out the pool of infection for other diseases. With effective ND control, increased flock sizes provide numerous hosts for any infectious agent, and increased trade in chickens and eggs might also contribute to the spread of infectious diseases.

Diseases related to poor nutrition might also become more important, since only a limited number of chickens may be able to obtain a balanced diet from the scavenging feed resource base (see Section 2.4).

In the south-eastern region of Africa, fowl pox appears to be the biggest potential problem, while in some parts of Asia, fowl cholera is widespread. Both diseases might gain importance once ND is under control but, because they have different methods of transmission, it is unlikely that either of them would ever become as severe as ND. Neither fowl cholera nor fowl pox spread over large areas or as quickly as ND. Apart from HPAI, this also applies to other diseases of village chickens.

Brief descriptions of a number of infectious diseases reported in village chickens are presented here. The diseases include those that should be considered in the differential diagnosis of ND, and those that might gain importance once ND is controlled.

The **clinical signs** and **post-mortem lesions of each disease are described**, as are **the cause**, **susceptible species** and ways of **transmission**, in order to show how the disease **spreads** and what are effective **control** mechanisms. Chapter 9 gives general information on prevention and control of infectious diseases. The notes provided here should be considered as a guide and, wherever possible, appropriate technical assistance should be sought to confirm diagnoses.

The diseases in this chapter are covered in alphabetical order regardless of their impact on village chicken production. Table 16 lists the diseases, grouping them according to whether the causative agents are viruses, bacteria, fungi, mycoplasmas, or internal or external parasites.

Table 16 Poultry diseases grouped by causative agent, with the section in which they are covered this manual indicated

Causative agent	Common name of disease	Section
Viruses		
Paramyxovirus	Newcastle disease	10
Influenza A virus	Avian influenza (fowl plague)	11.2
Poxvirus	Fowl pox	11.8
Birnavirus	Infectious bursal disease (IBD)/ Gumboro disease	11.10
Coronavirus	Infectious bronchitis	11.11
Herpesvirus	Infectious laryngotracheitis	11.13
Herpesvirus	Marek's disease	11.14
Bacteria		
Escherichia coli (with Mycoplasma gallisepticum)	Chronic respiratory disease	11.3
E. coli	Colisepticaemia	11.5
Pasteurella multocida	Fowl cholera (pasteurellosis)	11.7
Salmonella gallinarum	Fowl typhoid	11.9
Salmonella pullorum	Pullorum disease (bacillary white diarrhoea)	11.15
Haemophilus paragallinarum	Infectious coryza	11.12
Mycoplasmas		
Mycoplasma gallisepticum	Chronic respiratory disease	11.3
Internal parasites		
Coccidiosis	Coccidiosis	11.4
Ascaridia galli	Roundworms	11.16
Capillaria	Hairworms	11.16
Heterakis	Caecal worms	11.16
Tapeworms	Tapeworms	11.16
Gapeworms	Gapeworms	11.16
External parasites		
Echidnophaga gallinacea	Stickfast flea	11.6.1
Chicken lice	Lice	11.6.2
Knemidocoptes mutans	Scale leg mites	11.6.3
Epidermoptes bilobatus Ornithonyssus sylviarum Ornithonyssus bursa Dermanyssus gallinae	Skin mites	11.6.4
Ticks	Ticks	11.6.5

11.2 Highly pathogenic avian influenza (fowl plague)

Cause

Avian influenza is caused by influenza A virus. Influenza viruses can change their strength by mutation and re-assortment. Different subtypes of the influenza virus with reduced strength might not always cause a clinical disease. The very contagious and severe form of avian influenza is known as highly pathogenic avian influenza (HPAI).

Transmission

Influenza virus is shed in the droppings of, and any discharge from, infected birds. Although the virus can readily be destroyed by direct sunlight or heat, it may survive for several weeks in a pile of droppings.

The disease spreads:

- by direct contact between birds or contact with wild birds (agents in discharges and droppings are inhaled by other birds)
- by intake of contaminated feed or water
- between flocks, in infected dust particles
- on the shoes or clothes of people or on equipment (e.g. egg trays and cages).

Epidemiological studies in Thailand indicate that village flocks are at lower risk of HPAI infection than are small-scale and commercial-scale operations of broiler or layer chickens or quail.

Species affected

A wide variety of domestic and wild birds is susceptible, although clinical signs are observed mainly in chickens and turkeys. Ducks and geese may carry the virus without showing any signs.

Highly pathogenic avian influenza may affect humans, causing severe respiratory disease or even death.²

Clinical signs

Clinical signs may occur within a few hours of infection and vary depending on the subtype of virus. Highly pathogenic avian influenza may wipe out a whole flock within days. Signs include:

- sudden death with few clinical signs
- ruffled feathers
- inappetence (not eating)
- distressed and noisy breathing, coughing and sneezing
- discharge from the eyes or nose

²

Under some conditions, the influenza virus can spread from ducks or chickens and adapt to other hosts. Pigs play an important role as hosts for some subtypes of the virus (but not H5N1) that originate in poultry and may affect humans.

- swelling of the face, including combs and wattles
- drop in egg production
- soft-shelled eggs
- diarrhoea
- small haemorrhages under the skin (i.e. bruising; usually most visible on feet and legs)
- lameness
- twisted neck and tremors
- at least half of the flock dies within one week (50–100% mortality).

Incubation period

It is important to remember that immediately following infection a bird will appear healthy while the disease is in the incubation period. The incubation period for an individual bird is usually 2–7 days, depending on the strain of virus involved, the dose of virus received, and the species and age of the bird. In the case of HPAI H5N1, the incubation period is usually 2–5 days. The onset of severe disease in a flock of birds can take up to 18 days (Figure 36), especially in caged layers.

Post-mortem findings

If HPAI is suspected, it is important that personal protective equipment (PPE) be used if a post-mortem is conducted and that the post-mortem be done in a safe area away from the general public.

Post-mortem lesions are non-specific and include:

- small haemorrhages in lungs, air sacs, intestines, pancreas and heart
- small amounts of cheesy material between the intestines and on the liver and heart
- mucus or even bloody content in the trachea, sinuses and perhaps in the nasal cavity.

If birds died quickly, gross lesions may not be found.

Diagnosis

Avian influenza cannot be diagnosed on the basis of clinical signs alone. The diagnosis can be confirmed only by laboratory examination to confirm presence of the virus or, in certain circumstances, to detect specific antibodies to the virus.

Highly pathogenic avian influenza should be suspected when there is high mortality in chickens that have been vaccinated against ND within the previous 4 months.

Differential diagnosis

The differential diagnosis of HPAI varies according to the poultry production system (Table 17).



Figure 36. The development of clinical signs of avian influenza (AI) in a flock can take 2–18 days. Note that an infected bird can spread virus before it starts to show signs of sickness.

Table 17. Diseases other than highly pathogenic avian influenza that cause sudden high mortality or swelling of combs and wattles in chickens, grouped by production system

Clinical signs	Intensive production	Extensive production
Diseases causing sudden high mortality	Newcastle disease Infectious laryngotracheitis Infectious bursal disease/Gumboro disease Acute fowl cholera Duck plague (duck virus enteritis) Acute poisonings	Newcastle disease Acute fowl cholera Duck plague (duck virus enteritis) Acute poisonings
Diseases causing swelling of combs and wattles	Acute/chronic fowl cholera and other septicaemic diseases Bacterial cellulitis of the comb and wattles	Acute/chronic fowl cholera and other septicaemic diseases Bacterial cellulitis of the comb and wattles

Action plan for when HPAI is suspected

If you suspect a case of HPAI, remain calm and implement the guidelines provided by your local veterinary services. If you do not have guidelines available, the following actions should be implemented as quickly as possible. Quick and appropriate actions can prevent the spread of the disease.

- 1. Speak with the farmers, village leaders, health officials and nearest police officers to ensure that:
 - (i) the affected flock(s) is isolated and quarantined
 - (ii) all movement of poultry and pigs from the village stops immediately
 - (iii) other flocks of poultry in the village are confined as much as possible.
- 2. Send an urgent message to the relevant veterinary authority asking them to come and investigate the outbreak.
- Children, the elderly and sick people should have no contact with sick or dead birds. Any people who have been in contact with sick, dying or dead birds should be monitored for signs of illness and any illness reported to the medical services.

Avian influenza in humans should be suspected where an individual has:

- a body temperature of over 38 °C
- at least one of the following signs—muscle pain, cough, breathing difficulty, or shortness of breath
- has been in direct contact with sick or dead poultry in the preceding 7 days, lives in an area where unusual poultry deaths have been reported in the last 14 days, or has been looking after a pneumonia patient in the 10 days before the onset of the illness.

- 4. Sick and dead birds should not be eaten by people or predators. They should be buried or, if they cannot be buried, burnt. When burying in a pit, place 40 cm of soil on top of the carcasses, followed by a layer of agricultural lime or wood ash, then complete filling in the pit with more soil. Lime should not be placed directly on the carcasses as it slows decomposition.
- 5. Remind villagers to wash their hands with soap frequently. Clothes and items (e.g. water containers, feeders, cages etc.) that have come into contact with sick or dead birds should be dealt with in one or other of the following ways:
 - (i) put in a pile to await the arrival of the investigation team—place lime or wood ash under and over the pile
 - (ii) washed with detergent or disinfectant—contaminated clothing and equipment should not be washed near water sources used by the community or water birds

(iii) boiled in water for 5 minutes.

- Together with the villagers, identify a site suitable for the construction of a pit for the disposal of carcasses away from community wells and watercourses. In collaboration with the village leader, arrange for one or more pits to be dug.
- Collect a history of the movement of birds (including both domestic and wild birds) in the area over the previous month to inform the investigating team. Record when the last vaccination campaign against ND was conducted and which farmers participated in the campaign.
- If you have PPE issued by the veterinary authority, collect the dead birds into a central location on each farm or around each house where dead birds are located. Remember to disinfect your boots before you move between contaminated locations.
- If you do not have appropriate PPE, work with community leaders and local authorities to restrict the movement of people and animals onto the farm or area where the dead birds are located and wait for the investigation team to arrive.
- 10. Remember that high concentrations of HPAI virus can be present in the droppings (i.e. manure) of infected birds. Special care should be taken when handling manure or material contaminated with manure.

Prevention

Section 9.3 provides general advice on the prevention of disease in village flocks. In countries free of HPAI it is important that:

- border inspection services conduct regular surveillance
- · the legislation on trade in wild birds is enforced
- · the legislation on movement of poultry and poultry products is enforced
- groups of poultry traders be formed and training conducted on HPAI and how it can it be prevented and controlled
- meetings are held with owners of fighting cocks to raise their awareness of the risk from HPAI, with special emphasis on border areas.

Control

Avian influenza cannot be cured. Avian influenza is a **notifiable disease** because of its immense impact on poultry-keeping systems and potential impact on human health, and outbreaks must be reported to the veterinary authorities.

Initial response

Early detection of outbreaks is essential for the control of HPAI.

Following a confirmed laboratory diagnosis of HPAI, all birds on infected commercial farms, in infected village flocks and in high-risk contact areas are culled. This should be done rapidly and efficiently, in accordance with the national contingency plan. Good records must be kept to facilitate the payment of compensation to farming families.

Heavily contaminated manure represents a special problem in efforts to control influenza. Litter and manure can be disposed of by burial or rendered safe by composting in a pile covered with plastic.

Widespread outbreaks

Should HPAI spread and become endemic, then veterinary authorities may introduce the vaccination of poultry. The selection of the vaccine should be done in accordance with international FAO/OIE guidelines.

Vaccinated birds can still spread highly pathogenic avian influenza

Vaccinated birds can still be infected with virulent strains of HPAI and shed virulent virus without showing clinical signs of disease. However, the amount of virus shed will be less than that from non-vaccinated infected birds.

Disinfection

Soaps and disinfectants can inactivate the virus on contact with it. The strength and freshness of the disinfectant solution will influence the time required for virus inactivation, and so the manufacturer's instructions should be followed closely. The presence of organic material will reduce the effectiveness of disinfectants and so it is important to remove as much soil and manure as possible from cages, feeders, vehicles etc. before doing the final disinfection. Organic material removed from contaminated premises should be buried or composted.

Agricultural lime (i.e. powdered lime) and wood ash will inactivate the virus and are especially useful in chicken houses with earthen floors. The powdered lime or wood ash should be placed on the earthen floor and allowed to remain there for at least 2 days.

The difference between antiseptics, disinfectants and antibiotics

Antiseptics are physical or chemical agents that kill or inhibit the growth of micro-organisms on the external surfaces of the body. Some common antiseptics are alcohol, iodine, hydrogen peroxide and boric acid. **Germicides** are antiseptics that *kill* micro-organisms.

There is great variation in the ability of antiseptics to destroy micro-organisms, and in their effect on living tissue. Mercuric chloride, for example, is a powerful antiseptic, but it irritates delicate tissue. In contrast, silver nitrate kills fewer germs but can be used on the delicate tissues of the eyes and throat. There is also a great difference in the time required for different antiseptics to work. Iodine, one of the fastest-working antiseptics, kills bacteria within 30 seconds. Other antiseptics have slower, more residual action.

Disinfectants are agents which destroy micro-organisms found on non-living objects. Some common disinfectants are Virkon®, 70% alcohol and washing soda.

Antibiotics are agents that are used to treat infections in people and animals caused by bacteria and other micro-organisms.

 $\label{eq:source:} $$ Source: http://www.biology-online.org/dictionary/Antibiotic and 'The Columbia electronic encyclopedia', 6th ed. Copyright © 2006, Columbia University Press.$

Public health

People may be infected with avian influenza virus. In general, those infected with the currently circulating strain of H5N1 HPAI virus have suffered severe respiratory disease, and death has occurred in over 50% of reported cases.

The emergence, by re-assortment or mutation, of a highly pathogenic strain of influenza A which could transmit between people to cause a global pandemic is a matter of the gravest international concern. The most effective means of protecting human welfare is to combat the precursor virus in its avian hosts so as to prevent the opportunities for infection of other species and emergence of a pandemic strain.

Do not inhale the highly pathogenic avian influenza virus

Very poor protection: A cotton scarf tied over the nose will filter out approximately only 10% of any virus particles that are present in the air.

Poor protection: A dust mask will filter out around 13% of virus particles.

Excellent protection: The N95 (or P2) protective mask supplied with the personal protective equipment kit will filter out 95% of virus particles.

11.3 Chronic respiratory disease

Cause

Chronic respiratory disease (CRD) is caused by several infectious agents that affect the respiratory tract. In general, *Escherichia coli* and a bacteria-like organism called *Mycoplasma gallisepticum* are involved, but the infection is often complicated by chronic stress and the presence of other bacteria or viruses.

Transmission

The agents are shed in discharges from the eyes and nose of infected birds and can survive outside a bird (in droplets of discharge) for up to 3 days.

The disease is spread:

- by direct contact between birds (agents in discharges may be inhaled by other birds)
- via the air (but not over long distances)
- by carrier birds (chickens that have recovered from CRD can shed the causative agents for a long time)
- via the egg from infected hens to their chicks (i.e. vertical transmission).

Species affected

Chronic respiratory disease affects chickens, guineafowl, turkeys and other birds

Clinical signs

Clinical signs of CRD may be observed as early as 1 day after infection and are long lasting. Normally CRD spreads slowly through a flock causing mild respiratory disease characterised by:

- discharge from nose and eyes
- coughing or sneezing
- respiratory sounds
- swollen head
- reduced egg production.

A few birds may die. Signs may be more severe if the chickens are already suffering from other diseases.

Post-mortem findings

Post-mortem evidence of CRD includes:

- mucus in the trachea and sinuses
- reddish trachea
- thickened air sacs with cheesy content.

Control

Chronic respiratory disease can be treated using antibiotics but the disease may recur after treatment ends.

Chapter 9 provides general information on the prevention and control of infectious diseases.

11.4 Coccidiosis

Cause

Coccidiosis is caused by microscopic protozoan parasites called coccidia. In chickens there are several different coccidian species belonging to the genus *Eimeria* that may affect various parts of the intestine.

Transmission

Coccidia are shed in the droppings of infected birds and, in humid or wet environments, they can survive for up to a year. Other birds are infected by eating the coccidia.

The disease is spread:

- by contact with infected droppings
- · by contact with feed or water that has been contaminated by faeces
- on the shoes or clothes of people or on equipment.

Species affected

Domestic poultry and birds are affected by coccidiosis. The species of *Eimeria* that affect poultry are host-specific, meaning that a species that infects chickens does not infect, for example, turkeys and vice versa.

Clinical signs

Coccidiosis can affect all age groups but is most serious in young birds, in which mortality rates can be as high as 50%.

Clinical signs can be seen 4-6 days after infection and are characterised by:

- depression and listlessness
- diarrhoea
- loss of weight
- bloody droppings (in some cases)
- a pale comb.

Post-mortem findings

Post-mortem evidence of coccidiosis includes:

 lesions (grey–whitish patches, small haemorrhages) in the affected part of the intestines

- cheesy or mucous content in the intestines
- ballooning of the intestines.

Control

Infected flocks may be treated with coccidiostats if available. Nevertheless, the use of such agents without further measures to reduce the risk of re-infection will provide only a short, temporary improvement.

The most effective control measure is to minimise the risk of infection by keeping the number of coccidia in the chickens' environment as low as possible. The improvement of housing conditions (as described in Chapter 4) will greatly help in the control of coccidiosis: to minimise re-infection, remove the droppings daily, keep the chicken house clean and dry, and avoid overcrowding.

Chapter 9 provides general information on the prevention and control of infectious diseases.

11.5 Colisepticaemia

Cause

Colisepticaemia is caused by a bacterium called *Escherichia coli*. Other infectious agents and non-infectious factors (particularly poor husbandry) may predispose the bird to infection.

Transmission

The causative agent is shed in the droppings.

The disease spreads:

- by direct contact between birds (agents in the droppings may be inhaled by other birds)
- via the air
- · by contact with contaminated feed or water
- · on the shoes or clothes of people, or on equipment
- via the egg from infected hens to their chicks. This is common and may cause high chick mortality.

Species affected

All types of birds can be affected. The disease is reported most commonly in chickens, turkeys and ducks, but may also occur in guineafowl.

Clinical signs

Clinical signs may be seen 1–2 days after infection, mainly in young chicks, and include:

- weakness
- diarrhoea
- emaciation in growers

- lameness in growers (occasionally)
- heavy breathing in growers (occasionally).

Older chickens are better able to fight this disease, provided they are in good health and have good nutrition.

Post-mortem findings

Post-mortem evidence of colisepticaemia includes:

- · remnant egg yolk (persistent yolk sac) in the body cavity of young chicks
- fine cheesy layer on the intestines, liver and heart.

Control

Treatment using antibiotics is possible. Since the quality of husbandry practised plays an important role in the occurrence of colisepticaemia, improved husbandry and sanitary measures, as described in chapters 4 and 9, are very important in control of this disease.

Public health

While the organism is essentially specific to birds, there is a very low risk of people and other animals contracting the disease.

11.6 External parasites (fleas, mites etc.)

Infestation with external parasites is a common problem in free-range systems. High levels of infestation irritate the birds and cause scratching, preening, reduced productivity and sometimes anaemia. External parasites can also transmit infectious diseases such as fowl pox.

The most common external parasites (Figure 37) are described in this section so that extension staff will be able to identify the causative agents and control infestations.

General control measures:

- Remove bark from timber used in the chicken house so that parasites cannot hide underneath.
- Avoid crowded housing.
- Clean the shelter and the nests regularly and thoroughly; all bedding, litter and droppings must be removed.
- Spread ash or agricultural lime on the floors and walls of chicken shelters and nests.
- Use smoke to fumigate shelter and nests regularly.
- In the case of severe infestation, the chicken house and nests should be burnt and a new house built at a different location.
- Allow the chickens to bathe in fire ash.
- Use an insecticidal dusting powder or spray if available.

Remember:

- all birds must be treated at the same time otherwise parasites from untreated birds will soon spread back to the birds you have treated
- apply insecticidal spray or powder to the nests and the chicken house as well, since ticks, some mites and fleas do not live constantly on the bird
- repeat the treatment after 1 week. (Insecticides do not kill the eggs of mites. In the eggs, young mites develop within 1 week.)



Figure 37. Diagram showing the areas on the body where different types of external parasites of chickens are most likely to be found

11.6.1 Fleas

The most common flea found on chickens in tropical and subtropical areas is the stickfast flea (*Echidnophaga gallinacea*), a small, dark parasite that sticks in clusters to the skin of the bird's head (mainly around the eyes).

The eggs and young of the stickfast flea are found in the surroundings of the chickens, where they feed on dry blood, faeces or other organic material. Adult fleas stay on the bird permanently and feed on blood. Stickfast fleas may survive for weeks without food.

Clinical signs

The following signs are typical of infestation with fleas:

- birds are irritated and restless, and may scratch at the eyes
- the skin, comb and wattles are pale due to blood loss
- · there are crusted skin lesions where many fleas had stuck.

Chicks that are severely infested with fleas may die.

Control

To control fleas, the following steps should be taken:

- Kerosene, paraffin or petroleum jelly should be applied to the parasites several times a day (Figure 38). Within a short period, the fleas will die. Dead fleas might remain attached to the chicken for several days or even weeks.
- Brooding hens should be kept free from fleas to prevent infestation of young chicks.
- The general measures for control of external parasites (see above) should be adopted.



Figure 38. Application of paraffin to stickfast fleas using a feather

11.6.2 Lice

Lice are light yellowish-brown, cigar-shaped parasites of various sizes that can be found all over the body on the feathers. They stay permanently on the bird, and their small greyish eggs are attached in clusters to the feathers. Most lice feed on feathers; some species suck blood.

Clinical signs

The following signs are typical of infestation with lice:

- feathers are damaged
- birds may be irritated if the infestation is severe.

Control

The general control measures for external parasites (see above) should be followed.

11.6.3 Scaly leg mites

Scaly leg mites (*Knemidocoptes mutans*) burrow into and live in the skin on birds' legs and cause readily recognisable scales and deformation of the legs and feet.

Clinical signs

Chickens carrying scaly leg mites display thick scaly legs. In cases of severe infestation, lameness or malformation of the feet may occur.

Control

Scaly leg mites are difficult to treat. Soften the scales in water, then scrub them off and treat the legs with kerosene (also known as paraffin in some parts of the world), mineral oil (e.g. used engine oil; Figure 39), Vaseline or an insecticide. Repeat this procedure at least three times at weekly intervals. If it does not help, slaughter the bird.

In addition, the general control measures for external parasites should be followed.





11.6.4 Skin mites

Skin mites (*Epidermoptes bilobatus*) are tiny (about 1 mm long), dark, fastmoving, blood-sucking parasites. They prefer those parts of the chicken's body with few feathers, such as the head and under the wings.

There are several types of mites. Species such as *Ornithonyssus sylviarum* and *O. bursa* remain permanently on the bird, whereas other species, such as *Dermanyssus gallinae*, hide in nests or cracks in buildings where birds are living and emerge to suck blood only at night. Skin mites can live up to 8 months without a blood meal.

Clinical signs

The following signs are typical of skin mite infestation:

- birds are irritated and become thin and weak
- productivity falls (hens might even stop laying eggs or brooding)
- the skin, comb and wattles are pale due to blood loss.

Severely infested birds, especially chicks, may die.

Control

To control skin mites:

- remove the bark from timber used to construct shelters (to reduce hiding sites for the mites)
- lime perches and structures
- follow the general control measures for external parasites (see above).

11.6.5 Ticks

Ticks are small, blue or brownish, blood-sucking parasites that can be found on the skin, especially in parts of the body with few feathers, such as the head and under the wings.

Off the bird, they live in cracks, under the bark of branches used to build shelters, walls or trees where they also lay their eggs. Nymphs usually feed at night and can survive without food for as long as 15 months. Adult ticks can survive for more than 4 years without feeding on the blood of a bird.

Clinical signs

The following signs are typical of tick infestation:

- birds are irritated and become thin and weak
- productivity falls (hens may even stop laying eggs)
- the skin, comb and wattles are pale due to blood loss.

Control

To control ticks:

- remove the bark from timber used to construct shelters (to reduce hiding sites)
- follow the general control measures for external parasites (see above).

11.7 Fowl cholera (pasteurellosis)

Cause

Fowl cholera is caused by a bacterium called Pasteurella multocida.

Transmission

The agent is shed in discharges and droppings of infected birds. It can survive up to 30 days in water or soil, but is destroyed by direct sunlight, heat and drying.

The disease spreads:

- by direct contact between infected birds (infective agents in discharges and droppings are inhaled by other birds or enter via wounds)
- · by intake of contaminated feed or water
- · by contact with infected wild birds or farm animals
- on the shoes or clothes of people or on equipment.

Species affected

All poultry species are susceptible to fowl cholera although chickens and turkeys are the most prone to clinical disease.

Clinical signs

Fowl cholera usually affects birds that are more than 6 weeks old. Birds get sick 2–10 days after contact with the causative agent.

The acute form of the disease causes **high mortality within a few days** and birds may show no clinical signs. Characteristic signs of chronic fowl cholera are:

- many birds are tired and weak
- ruffled feathers, decreased appetite
- bluish comb and wattles
- swollen face and wattles
- swollen joints
- fast, distressed breathing
- coughing and sneezing
- clear to yellow discharge from eyes and beak
- watery diarrhoea and dirty vent.

Post-mortem findings

Post-mortem indicators of fowl cholera include:

- small haemorrhages in the lungs, intestines and heart
- cheesy material between the intestines, and on the liver and heart
- fluid in the pericardial sac and abdominal cavity.

Control

Good flock management that includes barring entry of sick birds, and the quarantining of new birds is advised. If the disease cannot be quickly controlled, it is better to cull the entire flock. Treatment using antibiotics is possible but mortality may reappear soon after treatment stops. Antibiotics that can be used include sulfur drugs in water (not recommended as they will affect the reproductive organs), oxytetracycline (Terramycin®), Aureomycin ®, novoviocin, lincomycin, spectinomycin in feed. Note that if these antibiotics are used, the withdrawal period is a minimum of 10 days before slaughter for consumption.

Vaccination is possible but does not always provoke good levels of protection. An inactivated vaccine using a local strain in an oil adjuvant can be produced by appropriately equipped laboratories. Village poultry should be vaccinated from 3 months of age onwards and best results are obtained when a booster is given 2 weeks after the first vaccination. Adequate flock protection can be achieved by conducting two campaigns of double vaccination (i.e. two vaccinations 2 weeks apart) per year.

Fowl cholera vaccine must be stored correctly

Inactivated fowl cholera vaccine must be stored at 2–8 °C, **not frozen**. If frozen, the walls of the fowl cholera bacteria will rupture releasing endotoxin that can result in the death of chickens following injection.

Chapter 9 provides general information on the prevention and control of infectious diseases.

11.8 Fowl pox

Cause

Fowl pox is caused by a poxvirus.

Transmission

The virus is contained in the characteristic scabs found on chickens affected by the disease. It can survive in dried scabs for months or years.

The disease spreads:

- via scabs which fall off the skin
- by direct contact between birds (The virus enters birds through skin wounds, via the eye or by inhalation. A rooster can transmit the disease by scratching and biting the hen while mating.)
- via insect bites (red mites, mosquitoes)
- on the shoes or clothes of people, or on equipment.

Species affected

Fowl pox affects chickens only (pox in other animals is caused by other types of poxviruses).

Clinical signs

Chickens of all age groups can be infected, but older birds are most commonly affected. The disease usually develops slowly over 2–3 weeks. Flock mortality is usually low but, in severe cases, up to half of the flock may die from fowl pox.

Wart-like lesions develop on the skin (**'skin form**') or inside the mouth (**'wet form'**, **'diphtheric form**'). Lesions can also be found on other parts of the body, such as the cloaca, skin of the wings or legs, but typical are:

- yellowish to dark-brown lesions on the head, particularly on the comb and wattles and around the eyes
- yellow-white, cheesy-looking lesions inside the mouth and on the tongue, maybe also inside the trachea and oesophagus (these lesions can grow together and block the bird's throat, and some birds may die because they cannot eat and breathe).

Skin lesions usually heal in 2 weeks. Birds that have recovered from fowl pox are usually immune and rarely get the disease again.

Post-mortem findings

Post-mortem examination may reveal yellow–white lesions inside the oesophagus and trachea or in the cloacal region.

Control

There is no specific treatment for fowl pox. Vaccination is possible if the vaccine and cold chain facilities are available. Fowl pox vaccine is usually applied by the wing-web method to 4-week-old chickens. Vaccination produces a mild form of the disease and should be applied strictly in accordance with the manufacturer's instructions. Once the vaccine vial is opened, its contents must be used within 2 hours.

Birds with mild lesions may survive if well cared for (by providing shelter, feed and water).

Chapter 9 provides general information on the prevention and control of infectious diseases.

11.9 Fowl typhoid

Cause

Fowl typhoid is caused by a bacterium called Salmonella gallinarum.

Transmission

The agent is shed in the droppings and can survive several months in the soil, dust or bedding. It is destroyed quickly when exposed to direct sunlight. The disease spreads:

- by direct contact between birds (via the beak or through wounds)
- · by contact with contaminated feed or water
- on the shoes or clothes of people or on equipment
- from infected hens to their chicks via the egg.

Species affected

Chickens, turkeys and guineafowl can contract fowl typhoid, which mainly affects adult birds but can cause mortality as high as 26% in chicks during the first month of life.

Clinical signs

Many older birds are affected, but normally only a few die. Clinical signs, which develop 2–5 days after infection, are:

- yellowish diarrhoea
- listlessness
- · rough feathers and drooping wings.

Post-mortem findings

Post-mortem indicators of fowl typhoid include:

- · swollen liver, spleen and kidneys, with small haemorrhages
- · small white spots in the liver, heart and sometimes the lungs
- in chronic cases, cheesy material between the intestines, on the liver and heart
- misshapen, grey-greenish follicles on the ovary.

Control

Treatment with antibiotics is possible but no antibiotic or combination of antibiotics has been found capable of eliminating infection from a treated flock. It is therefore best to kill birds that seem to be sick with fowl typhoid. If the bird is eaten inadvertently, it is unlikely to cause a problem provided that the meat was well cooked.

Chapter 9 provides general information on prevention and control of infectious diseases.

11.10 Infectious bursal disease/Gumboro disease

Cause

Infectious bursal disease (IBD)/Gumboro disease is caused by a birnavirus. Different strains of the virus are recognised and typing is required if control by vaccination is being considered.

Transmission

The virus is shed in the droppings and is very stable. It may survive up to 4 months in the environment.

The disease spreads:

- by direct contact between birds (agents are inhaled by other birds)
- · by contact with contaminated feed or water
- on the shoes or clothes of people, or on equipment
- from infected hens to their chicks via the egg.

Insects may act as carriers.

Species affected

Chickens and turkeys are susceptible to IBD/Gumboro.

Clinical signs

While birds of all age groups are susceptible to IBD/Gumboro, **only birds between 3 and 12 weeks of age show clinical signs**. Signs develop 2–3 days after infection. They include:

- · depression and listlessness
- birds huddling together
- pale skin
- diarrhoea and a dirty vent.

Depending on the strain involved, mortality can vary from 30% to 90%. Antibodies to IBD are frequently found in 30–40% of village chickens but clinical disease is rarely seen. (Note that the presence of antibodies indicates that the bird has been infected but does not necessarily that it became sick from the infection.)

Post-mortem findings

Post-mortem indicators of IBD/Gumboro include:

- haemorrhages under the skin and in the breast and thigh muscles
- pale kidneys
- an enlarged, gelatinous, bursa of Fabricius (an organ that is part of the bird's immune system) with bloody spots; at a later stage the bursa shrinks.

Control

There is no specific treatment for IBD/Gumboro. Vaccination is possible but not practicable under village conditions. Since there are various strains of IBD/Gumboro virus, if vaccination is considered, the causative strain must be determined to ensure that the vaccine specific to that strain is administered.

Chapter 9 provides general information on prevention and control of infectious diseases.

Birds between 3 and 12 weeks of age that survive the disease will be more susceptible to other diseases because of damage to their immune system.

11.11 Infectious bronchitis

Cause

Infectious bronchitis (IB) is caused by a coronavirus.

Transmission

The virus is shed with discharges and is readily destroyed outside the bird.

The disease spreads:

- by direct contact between birds (virus is inhaled by other birds)
- with infected dust particles from flock to flock
- on the shoes or clothes of people, or on equipment.

Species affected

Infectious bronchitis affects only chickens.

Clinical signs

All age groups are affected. While the disease is highly contagious and will affect almost all birds in a flock, it is most severe in young chicks in which it may cause many deaths.

Birds show clinical signs within 2 days of infection. While younger birds show mainly respiratory signs, hens often display only a drop in egg production. The following are signs typical of IB:

- Young chicks may die following severe respiratory distress.
- Young chickens may have heavy and noisy breathing, and have open beaks.
- Coughing and sneezing may be evident in young chickens.
- There is a drop in egg production.
- Deformed eggs with wrinkled and rough shells are laid.

Post-mortem findings

Post-mortem indicators of IB include:

- a red trachea containing mucus
- froth in air sacs
- a yellow, cheesy plug at the end of the trachea of younger chickens.

Virus subtypes that affect the kidneys and result in high mortality cause:

- pale, swollen kidneys
- white, sand-like material in the ureter (the vessel connecting the kidneys with the cloaca).

Control

Birds infected with IB subtypes causing renal damage should be protected from the cold and provided with electrolytes in the drinking water. This will lower mortality significantly. Vaccination is possible but not practicable under village conditions.

Chapter 9 provides general information on prevention and control of infectious diseases.

11.12 Infectious coryza

Cause

Infectious coryza is caused by a bacterium called Haemophilus paragallinarum.

Transmission

The agent is shed in discharges from the nose and eyes but can survive only a short time outside the bird.

The disease spreads:

- by direct contact between birds (agents are inhaled by other birds)
- by intake of contaminated feed or water
- with infected dust particles dispersing from flock to flock
- on the shoes or clothes of people, or on equipment
- by carrier birds (infected adult birds that are not showing signs but may introduce the disease into a new flock).

Species affected

Infectious coryza affects chickens, guineafowl and pheasants.

Clinical signs

Birds of all age groups are affected but the disease is generally more severe in older birds.

Clinical signs occur 1–3 days after infection. The disease can last from a few days to 2–3 months, although many birds show clinical signs that disappear after 14–21 days. Signs of infectious coryza include:

- · distressed and noisy breathing
- sneezing
- a nasal discharge that is clear at first but later becomes yellowish and foul-smelling
- · discharge from the eyes-the eyelids may stick together
- birds shaking their heads (to get rid of the discharge)
- swelling of the face.

Infectiouse coryza does not usually kill many birds, but feed and water intake are reduced and the birds lose weight.

Post-mortem findings

Watery discharges can be found in the nasal passages and sinuses of diseased birds.

Control

Infectious coryza can be treated using antibiotics such as oxytetracycline but drug resistance does develop. Relapse may occur following treatment. Commercial vaccine is available in some countries.

Avoid exposing birds to humid and cold conditions, which increase the severity of this disease.

Chapter 9 provides general information on prevention and control of infectious diseases.

11.13 Infectious laryngotracheitis

Cause

Infectious laryngotracheitis (ILT) is caused by a herpesvirus.

Transmission

The virus is shed with discharges and can survive in droppings and carcasses.

The disease spreads:

- by direct contact between birds (agents are inhaled by other birds)
- via the air
- · by contact with contaminated feed or water
- on the shoes or clothes of people, or on equipment
- by carrier birds (which may carry the virus for life).

Species affected

Infectious laryngotracheitis affects only chickens.

Clinical signs

All age groups of chickens are affected but the most characteristic signs are seen in adult birds.

Clinical signs occur 6-15 days after infection and include:

- gasping with stretched neck and open beak
- · wheezing and gurgling respiratory sounds, and severe respiratory distress
- coughing and sneezing
- conjunctivitis
- drop in egg production.

Up to half of the flock may die after severe respiratory distress.

Post-mortem findings

Bloody mucus and cheesy material may be found in the tracheae of diseased birds.

Control

There is no specific treatment for ILT. Vaccination is possible but not practicable under village conditions.

Chapter 9 provides general information on prevention and control of infectious diseases.

11.14 Marek's disease

Cause

Marek's disease (MD) is caused by a herpesvirus.

Transmission

The virus is shed with small parts of the feathers, fluff and dust. It can remain infectious for more than a year.

The disease spreads:

- by direct contact between birds (agents are inhaled by other birds)
- via the air
- by contact with contaminated feed or water
- on the shoes or clothes of people, or on equipment.

Species affected

Marek's disease affects domestic fowl including chickens, quail and pheasants. Young chicks are particularly susceptible to MD but resistance increases rapidly after the first few days of age.

Clinical signs

Clinical signs can be seen from 2 to more than 30 weeks after infection. They include:

- loss of feathers, nodules in the skin (in young birds from 4 weeks to 7 months of age)
- paralysis of one leg and/or wings (up to 7 months of age)
- loss of weight
- irregularly shaped pupils (in adult birds)
- lameness for a short period (in adult birds).

Mortality usually occurs between 10 and 20 weeks of age.

Post-mortem findings

Post-mortem indicators of MD are:

- tumours in internal organs such as the ovary, liver, spleen, kidney and heart (in young birds from 4 weeks to 7 months of age)
- thickened, greyish nerves, with loss of cross-striation (up to 7 months of age).

Control

Marek's disease cannot be cured. Vaccination of day-old chicks is possible but not practicable under village conditions. Selection for resistance to Marek's disease in chickens is possible.

Chapter 9 provides general information on prevention and control of infectious diseases.

11.15 Pullorum disease (bacillary white diarrhoea)

Cause

Pullorum disease is caused by a bacterium called Salmonella pullorum.

Transmission

The agent is shed in the droppings and can survive several months in the environment. It is destroyed quickly when exposed to direct sunlight.

The disease spreads:

- by direct contact between chicks (through the droppings)
- · on the shoes or clothes of people, or on equipment
- from infected hens to their chicks via the egg
- via surviving chicks, which may carry the virus for life.

Species affected

Chickens, turkeys, quail and pheasant can be affected by pullorum disease. Only young chicks show clinical signs of the disease, from which they die in large numbers.

Clinical signs

Signs of pullorum disease are:

- · chalk-white diarrhoea and a dirty vent
- · weakness and closed eyes
- drooping wings.

Post-mortem findings

Post-mortem indicators of pullorum disease include:

- remnant egg yolk (persistent yolk sac) in the body cavity of young chicks
- small, whitish spots in the liver, heart and sometimes the lungs.

Control

Treatment with antibiotics is possible but the disease might reappear with the next group of chicks. It is therefore better to kill the infected mother hen to avoid further spread.

Chapter 9 provides general information on prevention and control of infectious diseases.

Public health

There are rare reports of enteritis in humans due to *Salmonella pullorum* infection. If an infected bird is eaten inadvertently, it is unlikely to cause a problem if the meat and/or eggs were well cooked.

11.16 Internal parasites (worms)

A variety of worms may be found in the digestive system of chickens:

- Large white roundworms (ascarids) (5–11 cm long) live in the intestines (Figure 40).
- Small, fine hairworms (*Capillaria* species) (1.5–8 mm long) can be found throughout the intestinal tract.
- Caecal worms (*Heterakis gallinarum*) (1–1.5 cm long) are located only in the paired caeca.



Figure 40. The life cycle of Ascaridia galli is direct; that is, the parasite passes directly from one bird to another via ingestion of parasite eggs. Occasionally, earthworms can act as transport hosts. After infection, it usually takes 40–60 days before the bird starts to pass parasite eggs in its droppings.

- Tapeworms, consisting of many small segments (proglottids) (7–10 mm long), live in the small intestine.
- Several types of roundworms of various sizes can be found in the crop, oesophagus, proventriculus or gizzard of chickens.

Other worms can be found in the trachea (Y-shaped, reddish gapeworms) or the eye of chickens.

Transmission

Worm eggs are shed in the faeces. Warm, damp conditions allow the worm eggs to survive in the environment for a long time.

Some types of worms (tapeworms, flukes, *Heterakis* and some *Capillaria* species) pass through an intermediate host such as an insect, earthworm or snail, which then might be picked up by scavenging chickens. The eggs of other worms (ascarids, some *Capillaria* species) are directly picked up by other chickens in contaminated feed or water.

Clinical signs

Worms cause damage to the gut wall and take nutrients from the chicken they are infesting. Infestations are of greatest importance in young birds, resulting in:

- · loss of appetite and weight
- diarrhoea.

Worms or segments of tapeworms can be found in the faeces.

Control

Infestation with worms can be controlled using a suitable anthelmintic. However, the use of drugs for deworming without improving housing conditions as described in Chapter 4 will provide only a temporary improvement. Birds will be re-infested by the intake of worm eggs from their environment.

Reducing the numbers of worm eggs in the chickens' environment is crucial for the control of worms. This can be achieved by:

- cleaning the chicken house and removing droppings every week
- · cleaning feed and water containers daily
- avoiding development of wet and muddy areas around water containers or elsewhere.

Traditional remedies such as pawpaw seeds may be used by farmers in some areas to control internal parasites.

12 Concluding remarks

Poultry have contributed to human health and wellbeing for thousands of years. Most people now live in urban areas and the commercial poultry industry has an important role to play in the provision of good-quality poultry and poultry products for these consumers. Nevertheless, village poultry continue to be an important part of livelihood strategies for millions of rural communities. Village poultry improvement programs developed in collaboration with producers and traders can improve not only the wellbeing of rural communities but also provide good-quality poultry to urban consumers who are willing to pay a price premium for birds raised under free-range, village conditions.