INFECTIOUS DISEASE CONTROL IN MULTI-DOG ENVIRONMENTS

THE ESSENTIAL GUIDE FOR DOG BREEDERS

PRODUCED BY

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INTRODUCTION

Management and control of infectious disease is a significant challenge in situations where multiple dogs, particularly young puppies, are housed together. This Guide aims to provide information on practices which will help to both prevent infectious disease from being introduced, and management of diseases should they occur. An important first step in reducing the risk, is to maintain the general health and welfare of dogs through best practices in genetics, breeding policy, environment management and enrichment, exercise, human contact, welfare, injury prevention, grooming, dental care etc. However, these factors will not be addressed in any detail in this Guide, although some links to further reading on these topics have been provided in the Resources section.

DISCLAIMER: The information provided in this Guide is not intended to replace or supersede guidance provided in official licensing or regulatory guidelines (for example the Dog Breeding Establishment Guidelines). In the event, that there is any conflict between information contained in this Guide and the official guidelines, the recommendations in the official documents must be followed.

Checklist

The Guide provides a comprehensive overview of disease control practices, and can be read in its entirety, although a review of the checklist below might identify key areas to focus on.

Vaccination

A vaccination program is in place that covers key disease risks, including canine parvovirus, canine cough (aka kennel cough), leptospirosis, canine distemper and infectious hepatitis and all dogs are up to date with their program.

Quarantine procedure

Measures are in place to reduce risk of disease entry and spread through quarantine of new animals prior to introduction to the main facility and mixing with resident dogs and/or an "all in all out" policy is followed.

Isolation/hospitalisation

Measures are in place to promptly identify and isolate sick animals in a secure "hospital" area, so appropriate care can be provided and to minimise spread of disease.

Cleaning and disinfection

Protocols are in place to ensure regular cleaning and disinfection, including but not limited to regular cleaning of kennels, thorough cleaning and disinfection of pens between litters, cleaning of water/food bowls and other equipment.

Personnel biosecurity

Appropriate measures are implemented to prevent disease transmission via personnel movement, including hand hygiene, use of appropriate clothing, footwear and personal protective equipment (PPE) and provision of disinfectant points at entry/exit points.

Wildlife/rodent control

A suitable pest and rodent control programme is in place including, but not limited to, appropriate waste management and food storage facilities.

Facility construction and materials

All contact surfaces for kennels and materials/surfaces that come into contact with dogs must be constructed of an impervious material that facilitates thorough cleaning, disinfection and drainage in order to prevent/control disease.

Record keeping

Appropriate documentation and records are maintained including, but not limited to, information about disease management, such as type of disease and identity of animals affected, treatments administered, deaths etc.

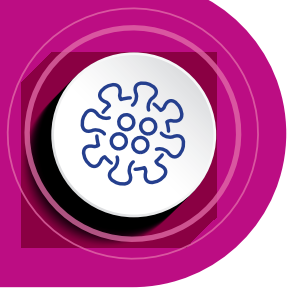
Training and refresher training

All new staff should be fully trained in the key elements of the above disease control strategy and existing staff should undergo refresher training to ensure that management practices are maintained best in class on an ongoing basis.

DISEASES

There is a wide range of infectious diseases that can cause issues in breeding establishments, and we have provided an overview below of selected key diseases that are commonly seen and/or present significant challenges. Although not specifically addressed below, canine distemper virus and adenovirus are also important viruses and protection should be provided through regular vaccination.

Canine parvovirus



Canine parvovirosis is a highly infectious viral disease of dogs which can cause serious, potentially fatal disease. Young puppies are particularly at risk, although dogs of any age can be affected.

Transmission

Canine parvovirus is a small, but extremely hardy virus that can survive in the environment for long periods of time – months or even years – and is **resistant to many household disinfectants**. The main source of infection is the faeces of infected dogs; the virus can be spread via items that are contaminated with faeces, such as **shoes and clothing**, the coat and pads of dogs, bedding, kennel surfaces, bowls or other equipment.

Signs of disease

Following infection, signs are not usually seen until 5 to 7 days later (the incubation period). Signs usually consist of depression, severe vomiting, refusal of food and water, abdominal pain and **profuse smelly, bloody diarrhoea**. This can result in rapid and severe dehydration, and ultimately death. If puppies recover their growth may be stunted.

Diagnosis

A history of parvovirus problems and/or compatible clinical signs are suggestive, but definitive diagnosis is important to confirm infection and ensure that appropriate control strategies are put in place. Various tests, including rapid point of care test kits are available – speak to your vet for advice.

Disease management and treatment

Prompt isolation of sick dogs is critical to minimise transmission and in-contact animals should be quarantined. For individual sick dogs, there is no specific treatment for parvovirus infection, although supportive therapy in the form of intravenous fluids are often given to correct the fluid loss due to vomiting and diarrhoea, and antibiotics might also be indicated to control secondary bacterial infections. Intensive barrier nursing care is also required.

Prevention

Vaccination is key to protecting against parvovirus, and vaccines are now available that can provide highly effective protection in pups as young as 4 weeks of age.

Prevention of disease transmission by applying stringent biosecurity, cleaning and disinfection procedures are also critical for managing the disease – further details are provided in the "Management of a parvovirus outbreak" section.

Canine Cough

Canine cough, also known as kennel cough or Canine Infectious Respiratory Disease, is a highly contagious respiratory disease that can affect dogs of all ages. The disease can be caused by a number of bacterial and viral agents including *Bordetella bronchiseptica* and canine parainfluenza virus. Infection with multiple viruses and/or bacteria at the same time is common and can cause more severe signs. Surveys of veterinary practitioners in Ireland have repeatedly shown that canine cough is the most common infectious disease encountered. Furthermore, it can affect dogs of all ages.

Transmission

The disease can be spread via airborne droplets, which can **travel for several metres in the air**, by direct nose to nose contact and also by contact with contaminated surfaces (equipment, clothing, bowls etc.)

Signs of disease

Following infection, signs are not usually seen until 3 to 7 days later (the incubation period). As the name suggests, the key sign is a **harsh, dry cough** – very much like whooping cough in humans. Other signs include sneezing and discharge from the eyes or nose. The coughing can last for several weeks and during this time more serious complications, such as pneumonia, may arise. In puppies or older dogs, or where there are other health problems, such complications can occasionally prove fatal.

Diagnosis

Diagnosis can be made on clinical signs (cough persisting for weeks) but finding out the identity of the specific causal agent can be difficult, due to the number of bacteria and viruses that can be involved. Diagnostic testing should be considered where there is a sudden increase in the number of cases, or disease seems more severe or prolonged than expected. The best test is PCR on a swab taken from the nose/pharynx – ask your vet for advice.

Disease management and treatment

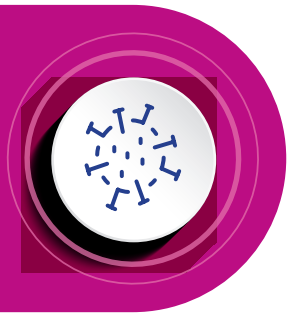
Prompt isolation of sick dogs is critical to minimise transmission and in-contact animals should be quarantined. Little can be done to cure the disease once it's started, particularly if the primary cause is viral; you simply make the dog as comfortable as possible and try to control the cough. In more severe cases, other drugs (e.g. antibiotics) may be needed to control secondary complications. The disease normally subsides after a few weeks.

Prevention

Vaccination is an important part of a respiratory disease control strategy and can help to reduce the signs of disease caused by some of the common causes, such as *Bordetella bronchiseptica* and canine parainfluenza virus. Intranasal vaccines are available which can be used from 3 weeks of age and induce immunity within 3 days. An injectable vaccine against *Bordetella bronchiseptica* is also available.

Reduction of disease transmission by applying stringent biosecurity, cleaning and disinfection procedures are also important measures. Most of the viruses and bacteria which cause canine cough are susceptible to commonly used disinfectants.

Canine Herpes Virus



Canine herpes virus, can cause a variety of diseases in dogs, depending on age, reproductive and immune status. The prevalence of the virus in Ireland is currently unknown. Following infection, dogs are infected for life, and might shed virus periodically, usually following a stressful event (such as whelping).

Transmission

Transmission usually occurs by contact between susceptible individuals and the infected oral, nasal, or vaginal secretions of shedding dogs. Many dogs shedding virus exhibit no clinical signs, making it almost impossible to identify asymptomatic carriers and eliminate the virus from the environment.

Signs of disease

There are a variety of possible outcomes following infection in dogs which have not been previously exposed. In pups less than 3 weeks old which have not received any immunity from the bitch, infection is often fatal and entire litters can be lost. Affected pups might stop nursing, persistently cry, have difficulty breathing, become bloated and have discharge from the nose. Pups older than 3 weeks usually have much less severe disease and infection in adult dogs is often asymptomatic. Mild ocular or upper respiratory signs might be seen, and blisters or ulcers around the vagina or prepuce have also been reported. Infection of pregnant bitches can cause abortion, stillbirths and / or birth of puppies which fail to thrive.

Diagnosis

Definitive diagnosis to establish whether herpes virus is involved, is usually required in cases where severe disease in young puppies is observed or litters are being lost. Post-mortem examination of puppies is the most effective test. Diagnosis in adult dogs can be done by detecting the virus (via a PCR test on a swab) or by detecting antibodies (via a blood sample). Results must be interpreted by your veterinary practitioner.

Disease management and treatment

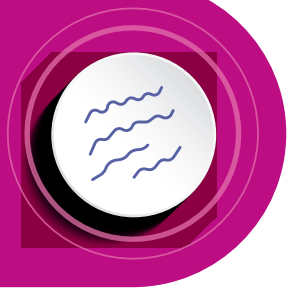
Treatment is not usually required for mild cases in adult dogs. In young puppies with severe disease, treatment is usually unsuccessful, and the prognosis for puppies that do survive is guarded, as there can be permanent damage to various organs.

Prevention

The most important step in preventing disease is **isolation of bitches for 3 weeks before and after whelping**, when she and the puppies are at highest risk. Most bitches who have a problem with herpes virus subsequently have normal litters, as they become immune and pass this immunity to the pups in milk. Keeping the whelping area warm can also help, as the virus likes to replicate at lower temperatures (<30C). In bitches with persistent problems due to herpes virus, a vaccine is available – ask your vet for advice.

Good hygiene practices are also important, to prevent transmission of the virus on equipment, hands, shoes etc. Herpes viruses are susceptible to most common disinfectants.

Leptospirosis



Leptospirosis is caused by microscopic bacteria (Leptospira spp.) belonging to a group called spirochaetes. There are many different variants, and the best known, *Leptospira icterohaemorrhagiae*, is spread by rats. Leptospirosis is currently considered to be the most widespread zoonotic infection (i.e. can also affect people) in the world. Infected dogs can be a source of infection for people in which it may also cause a potentially life-threatening disease. As there is now evidence of additional strains circulating in Ireland, it is wise to ensure your animals are protected with the vaccine that contains four strains of the lepto organism.

Transmission

Infected animals, such as rats, shed bacteria in their urine and transmission can occur either directly through contact with the infected urine, or indirectly – for example through contact with contaminated water. After exposure to the bacteria, the leptospires enter the blood stream. This is followed by a rapid replication in several tissues such as the kidney, liver and spleen. The bacteria are then excreted via the animal's urine back into the environment.

Signs of disease

Early signs can be vague, and it can be difficult to diagnose without further testing. However, if not treated early, the disease may progress to potentially fatal liver and/or kidney problems, causing lethargy, loss of appetite, abdominal pain, vomiting and jaundice.

Diagnosis

A diagnosis of leptospirosis might be suspected based on clinical signs but definitive diagnosis requires laboratory tests on blood and/or urine samples.

Disease management and treatment

As with most infectious diseases, prompt isolation of sick dogs is important to minimise transmission. If leptospirosis is suspected or confirmed, then care should also be taken to prevent transmission to people caring for the dog. Pregnant or immunosuppressed people should not have contact with affected dogs. The mainstay of treatment is antibiotics, and relatively long courses are required to clear the infection and reduce the risk of bacterial shedding. Supportive care is also required, such as intravenous fluids and medication to protect the gut and liver.

Prevention

Vaccination is key to protecting against leptospirosis, and annual boosters are required to maintain protection. Ask your vet about non-adjuvanted vaccines that contain four strains of leptospira.

As rodents can be an important source of infection, rodent control is an important factor in disease prevention.

DISEASE CONTROL RECOMMENDATIONS

This section of the Guide provides recommendations on some of the key measures that should be taken to control infectious diseases. The two broad objectives are to:

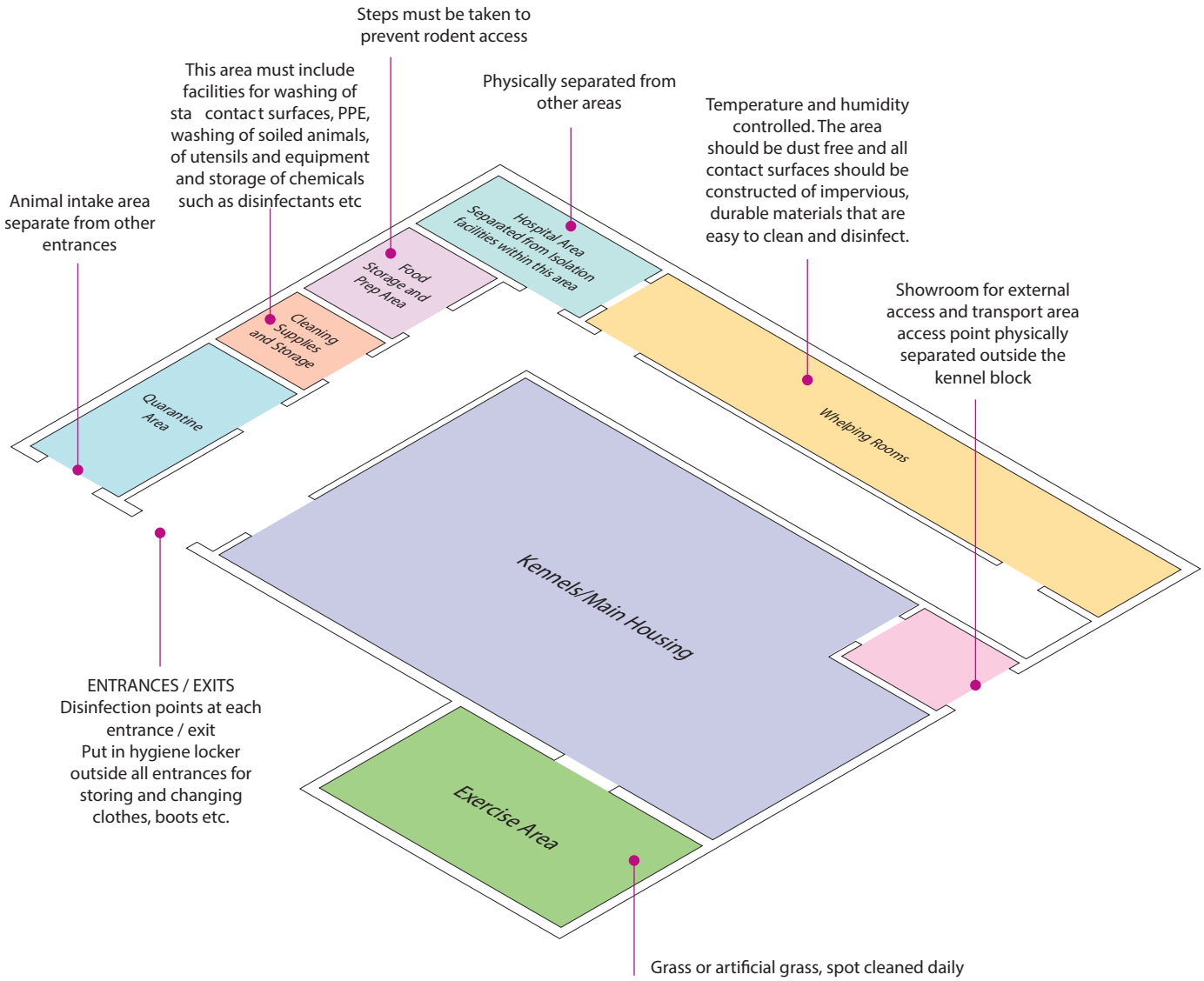
a. Exclude disease: lower the risk of infectious disease agents from entering your facilities

b. Restrict disease spread: control the spread of infectious disease within your facilities

The two objectives are closely related, and many of the steps that are used to exclude disease are also important for reducing spread. The icons above will be used to identify the objective associated with each of the measures described on the following pages.

Facilities Layout Schematic

The schematic layout below highlights some of the key measures that can be taken in different areas to prevent and/or control infectious diseases.



Other considerations:

- External biosecurity – Limited site access, secure fence perimeter, 24/7 surveillance
- Drainage and effluent storage appropriate to size of facilities

1. Isolation of sick animals

"Prompt removal of sick animals from the general population is the single most important step in controlling a communicable disease outbreak."

(from: Management of Disease Outbreaks in Animal Shelters, University of Florida)

- Sick animals should be isolated and moved away from the rest of the population as soon as signs of illness are seen, to reduce the risk of disease spread to in-contact animals.
- A secure hospitalisation area should be available for this purpose. Ideally this is a facility which is empty and ready to receive ill animals. It should be subject to physical separation from facilities for healthy animals regarding all inputs (staff, food, water, air supply utensils etc) and outputs (stale air outlet, faeces/urine outlets etc). Access for all non-essential humans, and all animals and wildlife must be prevented.
- Materials used in the isolation facility should be such that complete cleaning and disinfection is possible.
- Appropriate nursing and veterinary care should be provided, and diagnostic testing should be performed to identify the disease if unknown.
- Animals should be kept isolated until they have recovered and are not shedding disease – the duration of time depends on the disease. Your vet will advise you on appropriate timing.
- Gloves and protective clothing should be used when handing sick animals that are suspected of having an infectious disease. There should be a comprehensive cleaning and disinfection regime in place for the hospital area, separate to the protocol for the rest of the facility.

2. Quarantine

- New animals being introduced to the facility should be housed separately from the rest of the population for a period of at least 2 weeks before entering the general population. Dogs might appear to be healthy but could be in the early stages of infection, and a period of quarantine helps to reduce the risk of introducing an animal that is carrying disease but has not yet developed signs.
- In situations where a sick animal is identified, all dogs that were in recent close contact should be quarantined and not allowed to mix with the rest of the population. As per the point above, this helps to reduce the risk of apparently healthy infected dogs from spreading disease to other animals. Quarantined dogs should be closely observed and isolated (and treated) if they begin to show signs. The duration of quarantine depends on the disease – signs will become evident within a week of initial infection in many cases, but could take longer in some specific instances (for example, it can take 2 weeks for signs of Canine Distemper to be seen).

3. Hygiene

This is a critical component of any disease control strategy, and there are many elements to consider, from the frequency of cleaning to the type of disinfectant used.

IMPORTANT: The terms "cleaning" and "disinfection" are often used interchangeably. However, they are distinct measures and care should be taken to address each in the appropriate way. Cleaning is the removal of visible dirt and faeces, often using water and detergent, while disinfection is the application of chemicals to kill infectious agents.

General recommendations:

The following is not an exhaustive list of requirements, but aims to cover the key areas that should be considered:

- An adequate supply of hot and cold water with convenient access to taps, hoses etc. should be available.
- Particular care should be taken to clean areas with poor lighting and any crevices or junction points. Use a headtorch if required to inspect any areas of poor light for organic material. Areas of poor lighting should be rectified as soon as possible.
- Materials used for kennel construction should be durable and non-porous (for example, non-edible plastic). Wood should be avoided where possible as it is porous and difficult to clean.
- Adequate drainage is important to ensure that soiled water and organic materials do not pool in kennels or other areas. Drains should be covered with a grill i.e. modular channels with captive grates, to decrease contact between organic material and footwear.
- In addition to cleaning and disinfection, the importance of drying is often underestimated. Infectious agents generally prefer a moist environment, so allowing adequate time for cleaned surfaces to dry is a useful step in reducing risk, particularly in poorly drained areas.
- A written cleaning and disinfection plan should be created and followed, with adequate training provided to all staff as required.

A. Cleaning

Area	Requirements
Kennels	Clean kennels twice daily to remove all faecal material and soiled materials/ bedding. Wash (and disinfect) kennels twice weekly. Washing and disinfection on a more frequent basis than this can increase the risk of aerosol spread of viruses.
Whelping rooms	Whelping areas must be thoroughly cleaned and disinfected between bitches The area must be completely cleaned and all bedding changed within 24 hours of the completion of whelping.
Common areas/ pathways	High traffic areas and pathways should be cleaned and disinfected daily
Equipment and multi-use surfaces	Any surfaces that multiple animals come into contact with, such as tables, scales and crates should be cleaned between animals. Feeding utensils must be cleaned and disinfected every day while toys should be cleaned and disinfected when soiled or when transferred between different pens
Exercise areas	Should be cleaned daily and toys or other environmental enrichment aids should be washed and disinfected regularly. Areas of sand, gravel, grass, or other similar materials must be raked or spot cleaned with sufficient frequency to ensure all animals the freedom to avoid contact with excreta.

B. Disinfection

There are many different types of commercially available disinfectants, and the efficacy against infectious disease agents varies. Various factors should be considered when implementing a disinfection regime.

- **Type of disinfectant**

  Bleach (sodium hypochlorite) is generally considered to be highly effective, and is one of the few that is effective against parvovirus. However, it is not particularly effective when applied to contaminated surfaces, so it essential that surfaces are thoroughly cleaned prior to application. Other types of disinfectant, such as potassium peroxymonosulfate and accelerated hydrogen peroxide, are also reported to be effective against parvovirus. It is worth checking with your veterinary practitioner or consulting the label to determine if the product is effective against parvovirus.

- **Concentration and mixing**

  Care should be taken to ensure that the correct concentration is used; too dilute will not work effectively and too concentrated could cause toxicity. The manufacturer's instructions should be followed regarding how long the mixed disinfectant can be kept – some remain stable in solution for weeks and others only a few days.

- **Method of application**

  Mops and buckets should be avoided if possible, particularly when applying bleach, as it can quickly become inactivated if it contacts organic material. Squirt or spray bottles can be used for smaller jobs, and larger hand-held or knapsack style applicators (i.e, those used to apply pesticides) are an option for larger areas. Some disinfectant manufacturers provide specific dispensing equipment.

- **Contact time**

  Adequate time should be allowed following application for the disinfectant to take effect. The time varies by disinfectant type, but at least 10 minutes is usually required. Longer contact times are preferable if possible, particularly in lower temperatures or where some organic contamination is still present. This may require "fallowing" or resting individual areas or houses over days which also allows drying and is especially warranted after a significant disease event. Dessication and exposure to sunlight also help reduce risk from certain infectious agents.

C. Hand hygiene

Hand hygiene is recommended before and after animal contact, after removing faeces, after cleaning kennels/crates, after handling animal equipment, after contact with pet food, and before eating or drinking. Hands should be washed with soap and water or an alcohol-based sanitiser should be applied when moving from one group to another. Sanitising stations should be provided at main entry/exit points between different areas of the facility.

D. Footwear and clothing

Appropriate footwear, which can be easily washed and disinfected when entering or exiting the facility or moving between groups, should be worn (for e.g., wellington boots). Protective overclothes that can be washed and disinfected frequently (once per week) could also be used. The use of gloves and protective clothing (such as disposable gowns) is particularly important when handling sick, potentially infected animals.

COMMON PITFALLS

Some common issues with cleaning and disinfection regimes include:

- Incorrect use of disinfectants
  - Wrong type of disinfectant
  - Inadequate cleaning before application
  - Inadequate contact time
- Poor drainage and accumulation of contaminated liquid
- Inadequate drying time

4. Vaccination

Vaccination is one of the most powerful tools for prevention and control of infectious diseases. All dogs and puppies should be vaccinated against key diseases. A written vaccination program should be developed in conjunction with your vet and appropriate records kept to ensure all dogs are up to date.

Core Vaccines:

Core vaccines should be administered to all dogs, covering the following diseases:

- Canine parvovirosis
- Canine cough (*Bordetella bronchiseptica* & Canine parainfluenza virus)
- Canine distemper virus
- Infectious canine hepatitis (Canine adenovirus)
- Leptospirosis

Optional vaccinations, which might be required depending on circumstances, include canine herpesvirus and rabies.

Vaccination protocols

Protocols can vary depending on the vaccine and specific circumstances. Generally speaking, puppies and unvaccinated adult dogs should receive a primary course of injections, 2 to 4 weeks apart followed by regular boosters. Vaccination of puppies generally starts at 6 to 8 weeks, although earlier vaccination might be indicated in some situations (see parvovirus information below). Annual boosters are required for leptospirosis and canine cough.

Parvovirus

In facilities experiencing an outbreak of parvovirus or where there is a history of parvovirus problems, early vaccination of pups is recommended. A vaccine became available in 2021 which can be used from 4 weeks of age and has been shown to be effective in the presence of maternally derived antibody – ask your vet for more information. For further information, see the sections on Management of a Parvovirus Outbreak and the Immunity Gap below.

Other considerations

Some other points to consider with regard to vaccination include:

- Storage. If vaccines are being stored on site, they must be kept at the appropriate temperature (i.e. in a well maintained and functioning fridge) and out of direct sunlight.
- One dose = one dog. Although it might be tempting to split vaccines and administer one dose to multiple dogs, this is not good practice and there is a significant risk of inadequate protection. This is especially important in young puppies where vaccines are being hindered by maternally derived antibody (Further information in "Immunity Gap" section below).

5. Facility design

This Guide is not intended to provide a comprehensive overview of facility design and construction, but the following points regarding infection control should be considered:

- **Capacity**

  The amount of space should be appropriate for the number of dogs. Overcrowding is an important risk factor for disease spread and contributes to physiological stress in the dogs, increasing susceptibility to infection.

- **Materials**

  The materials used for construction should be smooth and non-porous, to facilitate easier cleaning, disinfection and drainage. Wood should be avoided in kennels as it is porous and difficult to clean/disinfect.

- **Ventilation and airflow**

  Adequate ventilation is important to reduce the risk of air-borne disease transmission, reduce odours and facilitate drying of surfaces after cleaning. The system must be sufficient to ensure 8-12 air changes per hour to prevent odour build up. All systems must be well serviced and maintained. Ammonia levels should be limited to no more than 25 ppm for no longer than 8 hours per day.

- **Temperature and humidity**

  Extremes of temperature should be avoided, and an appropriate means of monitoring temperature should be available. Ambient temperature should not fall below 10 °C. This is particularly important in whelping areas, as newborn pups cannot regulate their own body temperature and diseases take advantage of this stress. High levels of humidity should be avoided through providing adequate ventilation, as moist environments favour the survival of disease agents and relative humidity greater than 70% can lead to heat stress.

- **Lighting**

  There should be adequate lighting, preferably natural daylight supplemented by artificial means, to monitor the condition and health of the dogs, and to allow proper cleaning. Areas of poor lighting should be checked with a torch to ensure that they are clean. Housing areas should be protected against excessive light.

- **Drainage**

  Adequate drainage is important to ensure that soiled water and organic materials do not pool in kennels or other areas. Drains should be covered with a grill i.e. modular channels with captive grates, to decrease contact between organic material and footwear.

- **Exercise area**

  Should provide adequate space depending on the size and exercise needs of the dogs which have access to it. This area should ideally be separate from animal housing. The surface area should be grass or preferably artificial grass. One third of the area should be covered by utilising a shade sail. A permanent supply of clean drinking water is to be available in each exercise area – inspected every day. Measures should be in place to minimise the deterioration of exercise areas to bare earth. Daily inspection should also include removal of faeces.

- **Storage**

  Supplies of food and bedding must be stored in a manner that protects the supplies from spoilage, contamination and vermin infestation. The supplies must be stored off the floor and away from the walls to allow cleaning underneath and around the supplies. Foods requiring refrigeration must be stored accordingly, and all food must be stored in a manner that prevents contamination and deterioration. All open supplies of food and bedding must be kept in leakproof containers with tightly fitting lids to prevent contamination and spoilage.

6. Other recommendations

There are a variety of other measures which must be considered when implementing a disease control strategy. These include:

- **Access controls**

  Disease can be carried by vehicles, people or equipment, so appropriate controls should be in place to restrict access to approved personnel. All people entering the facility should disinfect their hands and footwear prior to entry and after exiting, and appropriate protective overclothes should be provided. Ideally only staff should be given access to the facility.

- **Pest control**

  Disease can also be introduced by wild animals or rodents. A particular concern here is leptospirosis which can be carried by rats. A documented pest control programme should be in place, and food storage and waste areas should be secure to prevent rodents gaining access.

- **Documentation**

  It is important to maintain adequate records, including but not limited to treatments, deaths, diagnoses and illnesses (type of disease and identity of animals affected). As mentioned above, written programmes should be developed and maintained to cover vaccination, parasite control, cleaning & disinfection and pest control policies.

- **Staff training**

  All personnel involved in caring for the dogs should receive training. A non-exhaustive list of topics includes how to monitor the health of the dogs and recognise disease, animal handling techniques, cleaning procedures and food preparation. Regular refresher training should be provided.

- **Movement of dogs**

  Transport of dogs into or out of the facility, and movement of dogs within the facility, increase the potential risk of disease introduction or spread. Steps should be taken to minimise risk, including:

  - Quarantine of new arrivals (see section 2 above).
  - Cleaning and disinfection of vehicles used for transport prior to all journeys.
  - Applying an "all in/all out" policy if moving groups of dogs/pups and keeping groups together as much as possible to avoid mixing of dogs between groups.
  - Thorough cleaning and disinfection before introducing a dog or group of dogs to a new area.

- **Noise management**

  Noise stresses animals and may increase susceptibility to disease – many are exposed to noise levels as high as 100-120 dB during the day. This exceeds the Occupational Safety and Health Assessment levels of safe hearing for humans. To help reduce noise stress, incorporate sound-reducing panels into kennel design. If noise is excessive – develop a plan that might include:

  - Consistent positive interaction time with staff
  - Exposing dogs to dog-appeasing pheromones
  - Playing music in the kennel

MANAGEMENT OF A PARVOVIRUS OUTBREAK

An outbreak of parvovirus can have a devastating impact, particularly in young puppies, and can be difficult to manage. This section of the Guide aims to provide some specific advice should an outbreak occur, and should be read in conjunction with the sections on parvovirus and disease control recommendations above.

The key steps to take if parvovirus is suspected are:

1. Isolation of sick animals

This is a critical step to help minimise disease transmission to in-contact animals. Prompt identification and removal of dogs with suspect clinical signs (see Parvovirus section for details) to the designated hospital area. Gloves and protective clothing should be worn when handling sick pets and strict hygiene protocols must be implemented immediately – see below. The attending vet should be immediately informed so that prompt, aggressive treatment can be started and diagnostic tests performed (see Step 3).

2. Quarantine in-contact animals

All dogs that have been in contact with the affected sick animal(s) in the previous 4 days (infected dogs can shed virus for several days before becoming sick) should be quarantined for at least 10 days, and not mixed with other dogs in the general population. As above, **strict hygiene measures** should be implemented when handling the in-contact dog(s), to prevent inadvertent transmission. Equipment, such as food and water bowls etc., used for this group should not be used for other dogs and should be moved to the quarantine area along with the animals concerned. These dogs should be monitored carefully for signs of illness and promptly removed to the hospital area if signs are seen. If new cases of disease are identified in the in-contact dogs, the 10 day quarantine period should be restarted. If possible, assign specific people to manage the quarantined dogs; the person/people assigned to this area should not have contact with other areas/dogs in the facility, particularly the more vulnerable animals (i.e. young puppies).

3. Confirm diagnosis

Diagnosis should be confirmed, preferably using rapid in-house tests. Do not wait for test results before implementing other control measures, particularly if there is a history of parvovirus problems in the facility.

4. Hygiene protocols

Parvovirus is a very resistant virus that can survive for long periods in the environment, and can be spread between dogs via hands, clothing (especially footwear), equipment etc. Strict cleaning and disinfection protocols must be immediately introduced, including the following steps:

- Hand sanitisation and disinfectant points should be set up at entrances/exits between areas.
- Protective clothing and gloves should be worn when handling sick or in-contact dogs.
- Kennel areas should be cleaned daily and thoroughly washed and disinfected twice per week .
- High traffic areas and pathways should be cleaned and disinfected daily.

TOP TIPS FOR CLEANING & DISINFECTION

- Thoroughly clean the area before applying the disinfectant – pay particular attention to cracks, crevices and junctions to ensure all organic matter is removed. Remove any puddles or pools of water before applying disinfectant. Do not use high pressure hoses/washers if the dogs cannot be removed from the area, as the force of the spray can spread infected material all over the surfaces and into the air
- Choice of disinfectant: some disinfectants are not effective against parvovirus, so ensure that the product you use contains one of the following ingredients – sodium hypochlorite, calcium hypochlorite, potassium peroxymonosulfate, or accelerated hydrogen peroxide. For products containing other ingredients, your local veterinary practitioner will advise you if they are effective against parvovirus as well as how to achieve best results
- Method of application for disinfectant: avoid mop & bucket if possible and use a sprayer or manufacturer approved system
- Allow sufficient contact time for the disinfectant to take effect – minimum 10 minutes but preferably longer (1 hour)
- Allow the disinfected area to dry before re-introducing the dogs if possible; if not, dry the area with a squeegee or towel

5. Vaccination

Vaccination is the cornerstone of parvovirus prevention and can also be used to help manage an ongoing outbreak. Parvovirus vaccines are highly effective when used as directed and can induce protective immunity within a few days. However, there are some factors to consider when vaccinating puppies (see below) and vaccination alone cannot eradicate the problem – it must be used in conjunction with the other measures previously outlined.

Adult dogs (>6 months old)

If not already vaccinated, all healthy adult dogs should receive a dose of parvovirus vaccine.

Puppies (<6 months old)

Puppies are the most vulnerable group, and there are some important factors to consider regarding vaccination of younger dogs. In the first few weeks/months of life, puppies are likely to be protected by antibodies (known as maternally derived antibodies or MDA) they receive from milk (assuming that the bitch has antibodies in her blood from either previous infection or vaccination). These antibodies gradually decline, so the level of protection reduces over time. These antibodies can also interfere with response to vaccination, and there is a window of time during which the level of antibodies does not protect against infection but still interferes with vaccination - the "Immunity Gap" (see more details below). At least, this was the case with previous vaccines, but the good news is that there is **now a vaccine available which works even in the face of high levels of MDA, and can be used in puppies from 4 weeks old** – please ask your vet for details.

In cases where there is an ongoing outbreak or a history of parvovirus problems, puppies should be vaccinated at 4 weeks old, with repeated vaccinations administered at regular intervals (every 2 to 4 weeks) until they are 10 weeks old.

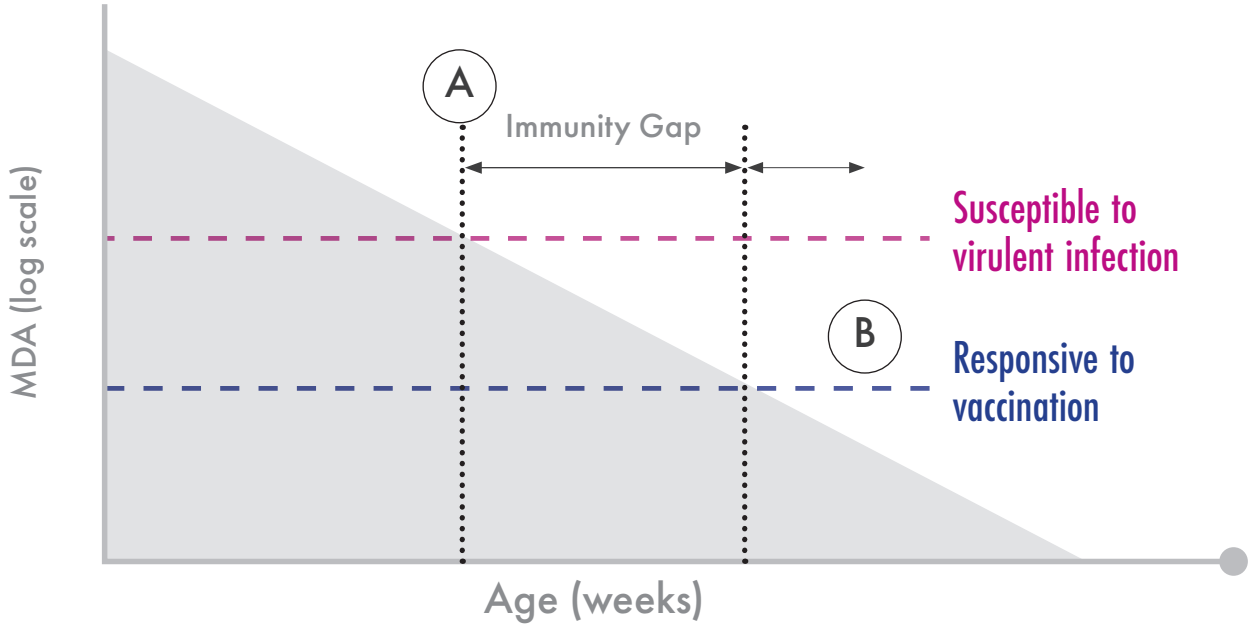
THE IMMUNITY GAP

After birth pups receive antibodies from their mothers through colostrum. These antibodies are very important in protecting the pups from diseases such as parvo in the early weeks of life. The maternal antibodies decline weekly and hence the protection they provide wanes.

The immunity gap refers to a time period which includes the following:

- It starts at a time (A in graph below) when the maternally derived antibodies are no longer protective – It is important to realise that there is, after this point, a time when the antibodies are still sufficiently high to block the vaccine from working but yet are not protective against clinical disease. Any vaccine administered during this time may not provide protection at all, or may only provide partial protection.
- It ends at the time point where the vaccine is no longer interfered with by maternally derived antibodies i.e. the vaccine now works effectively but the time taken for onset of immunity for the vaccine must be added to this time point to result in time B (See graph below) from which puppies are protected.

This means that during the Immunity Gap and while the Onset of Immunity is occurring that pups are particularly susceptible to disease. This is because the protection provided from the mother's antibodies is not at a high enough level to protect from disease but is still sufficiently high to interfere with the vaccine's ability to induce an adequate amount of protection against disease. The Onset of Immunity refers to the amount of time it takes for the body to mount a protective immune response to disease post vaccination.



(MDA= Maternally Derived Antibody)

The Immunity Gap has been a significant challenge for protecting young pups, as traditional vaccines do not work effectively in the presence of high levels of MDA. **However, recent advances in vaccine technology mean that there is now a vaccine available which works even in the face of high levels of MDA**, which can be used in puppies from 4 weeks old – please ask your vet for details.

RESOURCES

Regulatory/legal requirements in Republic of Ireland

- Dog Breeding Establishment Guidelines

  https://www.gov.ie/en/publication/7d9fcf-dog-breeding-establishment-guidelines-2018/
- Rules on the Sale, Supply and Advertising of Pet Animals

  https://www.gov.ie/en/publication/d3af4-new-rules-on-the-sale-supply-and-advertising-of-pet-animals/

NI regulatory/legal requirements

- Council licensing of Dog Breeding Establishments

  https://www.daera-ni.gov.uk/articles/council-licensing-dog-breeding-establishments

Other resources

Please note that some of the resources and links provided below refer to rescue/shelter environments and/or are from sources outside of Ireland. Nonetheless, the key principles of disease control are applicable to any multi-dog establishment.

Management of Disease Outbreaks in Animal Shelters

Includes some practical advice on disease management and also a specific guide regarding parvovirus outbreaks from the University of Florida

https://sheltermedicine.vetmed.ufl.edu/files/2017/01/Management-of-disease-outbreaks-in-shelters.2018.pdf

https://sheltermedicine.vetmed.ufl.edu/wordpress/files/2021/05/Canine-and-Feline-Parvovirus-Infections-in-Shelters.2021.pdf

Research into Commercial Breeding Kennels from Purdue University

Features findings from studies into various aspects of dog breeding and advice on several areas, including environmental management

https://vet.purdue.edu/discovery/croney/current-research-welfare-breeding-dogs.php

Guidance on cleaning and disinfection

Comprehensive guide to cleaning and disinfection regimes from the Koret School of Shelter Medicine at UC Davis.

https://www.sheltermedicine.com/library/resources/?r=sanitation-in-animal-shelters

This guide is provided for information purposes and is not intended as a substitute for veterinary advice.
Please speak to to your vet if you have any questions about vaccination or health concerns.

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