Canine Parvovirus (CPV) is an insidious virus, causing disease in thousands of puppies and dogs across Australia every year, with close to 50% mortality in infected cases (including puppies that are euthanised given the poor prognosis and cost of treatment). At times, veterinarians will see not just isolated cases but outbreaks of disease and during outbreaks extra caution is needed to protect patients that are not yet fully immunocompetent.

During disease outbreaks, cases will include dogs and puppies that have been previously vaccinated and where vaccine failures have occurred. It is recognised that while vaccines against CPV are highly effective, vaccination breakdown can occur under the pressure of outbreak conditions. Here we discuss the best practice vaccination protocols to use in times of Canine Parvovirus outbreak and discuss why outbreaks occur.

### Risk factors for Canine Parvovirus

Traditionally this disease is thought of as a Spring/Summer disease, and data demonstrates that Summer indeed appears to carry the highest risk for death from CPV, however Autumn may have a higher risk for seeing the most number of CPV cases Australia-wide. A recent Australian study showed that in 2010, 32 per cent of cases of CPV occurred in Autumn, compared to 28 per cent in Spring and 22 per cent in Summer.

The risk of death from CPV was reported to be the highest in Summer with a case fatality rate of 25 per cent, followed by Autumn at 16 per cent.

This statistic demonstrates a need for all veterinarians and pet owners to be aware of the risks of CPV during these times of the year and shows the need for vigilance and ensuring that everything is done to maintain herd immunity and protection of puppies and dogs at these times, especially during outbreak situations.

As well as seasonality, other risk factors for death from CPV were identified as pedigree-type and region, while risk of euthanasia is increased for dogs in certain regions, during summer, and dependant on age and vaccination status. Socioeconomics has also been linked to Canine Parvovirus disease case clustering in Australia.

The pedigree types linked to a higher risk of Parvo death were hounds, non-sporting dogs and gun dogs.

Risk for euthanasia due to Parvo appears to be increased for dogs in Qld, and then NT/Tas/SA, while risk of death (in cases that died from the disease and not euthanasia) appears to be highest in NSW. Reasons for these discrepancies are not fully understood and may relate to socioeconomics, population densities, local differences in disease pathogenicity or co-infections and other confounding variables.

Summer presents a greater risk for both death from Parvo directly or euthanasia due to Parvo. Dogs that are unvaccinated or not recently vaccinated were more likely to be euthanased due to this disease.
Reasons for failure of vaccination in animals

Reasons for vaccine failure (including CPV-vaccine failure) are many, and no vaccine will stimulate an immune response in 100% of the population to which it is administered. Factors that contribute to vaccine failure include interference from maternal antibody, immunosuppression, stress, debilitation or malnutrition, concurrent illness, incubation of disease prior to vaccination, interference from medications, pyrexia and hyperthermia, or concurrent surgery or anaesthesia.

While each of these factors could certainly contribute to overall decreased immunocompetency, the complexity of the immune system and interaction between the host and the pathogen, means that no individual factor alone can generally definitively be implicated in failure of a vaccine to induce immunity. In trials, immunity from vaccination has been demonstrated to be unaffected by certain factors alone (such as anaesthesia and surgery). The degree of severity of each influencing factor and the subsequent level of exposure to virus (and degree of virulence of the virus strain) will influence the clinical progression of disease that may occur following exposure.

Why epidemics occur

Epidemics of disease occur when transmission of a pathogen happens rapidly from infected individuals or the environment, to a susceptible population. An epidemic will be worse where there is a large susceptible population and a significant exposure of this population to disease. Where a disease is also highly transmissible and causes severe clinical signs, then the outbreak of disease will be more serious.

With many diseases, we generally don’t know how large our susceptible populations are, until the event of a disease outbreak. Often we assume that ‘good herd immunity’ has been maintained because we are not seeing disease cases. However it can be easy to be lulled into a false sense of security if we are not seeing disease – just because we are in an ‘epidemic interval’ (that is a period of no disease that lies between 2 periods of disease).

For an epidemic to start, we need three things:

1. A susceptible population – that is a population that is not immune to a disease, because it has not been sufficiently vaccinated or has not developed immunity from previous exposure to disease

2. A ‘seed case’ – disease to be introduced to the population that starts spreading

3. An environment that favours disease transmission – eg a population that mingles or can transmit disease between individuals

In the case of Canine Parvovirus it easy to see this situation occur. Puppies are constantly being born and these dogs will not have active immunity to Canine Parvovirus until they have been exposed to disease or until they have been vaccinated. Furthermore, immunity from vaccination is not guaranteed – if pups do not receive their last ‘puppy booster’ vaccination at the right age then Maternally Derived Antibodies may interfere with the vaccination that we are relying on for longer-lasting immunity. Neither will every dog will respond maximally to every vaccination.
Many situations may result in a less-than-optimal response to vaccination (eg a dog harbouring another infection at the time of vaccination or other reasons for immune suppression so it doesn’t respond to the vaccine). This can lead to a potential for disease if this patient is exposed to a serious pathogen at a later date, and isn’t immune. If these dogs are not re-vaccinated at some stage, they will continue to remain at risk.

Transmission of CPV can come from many different sources. Direct transmission comes from infected patients’ faecal spread. A contaminated environment may then lead to indirect transmission on fomites such as shoes or other objects. Cats can carry and shed various new strains of Canine Parvovirus – and the significance of this is still being investigated. Subclinical carriage and shedding of Canine Parvovirus has been reported at up to 80 per cent of cases. All of these areas represent potential sources of infection for naïve animals.

If we have a susceptible population then we only need the introduction of disease and a favourable environment and a Parvo epidemic can start.

**How to stop an epidemic**

An epidemic can be stopped by addressing the factors allowing transmission of disease to occur. Given that in outbreak conditions we already have the seed case, we can either address the susceptible population; we can address the environment of transmission, or both.

Reduction of transmission involves adequately cleaning any contaminated areas where this is possible and reducing the access of susceptible patients to these areas where they are at risk of exposure to the disease.

Viral shedding can occur generally up to 2 weeks post recovery however may occur for longer (even as high as 5 weeks post infection), and affected animals should be isolated during this period. Given CPV’s high resistance to inactivation, and potential for persistence in the environment, precautions need be taken to prevent spread. Fomites can easily carry infection between areas with affected and unaffected animals. Humans’ shoes, clothes and skin can act as fomites, and great care must be taken by anyone handling dogs or contaminated materials, not to spread infection to other dogs, or cats, or into the environment. Housing, bedding, and other material in contact with affected animals should be thoroughly cleaned with a dilute bleach solution (1 part bleach : 24 parts water) on a regular basis.

Given the ubiquitous nature of Canine Parvo, once it is present in an environment, it is difficult to completely remove the pathogen – so it is certainly prudent to focus on improving the susceptible population as well. Adequate cleaning of facilities that have held Parvo positive patients is essential to reduce the risk of direct exposure to dogs that are subsequently held in the same facilities.

Reducing the susceptible population involves either adequate vaccination or exposure to disease and development of acquired immunity through natural infection. Both of these methods will result in improved herd immunity, however exposure to natural infection clearly risks development of clinical signs and potential death – as well as a risk of further transmission of disease to others before immunity develops. So clearly, vaccination is a far better option.

If we can vaccinate enough of a population then we will have two effects. The first effect is a direct effect on the individuals vaccinated because they will be protected from developing disease. The second effect is that through reduction of disease transmission, we can aim to bring the epidemic under control.
Recommendations to provide best protection for puppies

During Parvovirus outbreak conditions, in order to provide the best protection for those puppies that may have higher than normal maternally derived antibodies or that may not respond completely to vaccination at 12 weeks, a further vaccination at 14-16 weeks must be performed. Where a patient is thought to not respond to vaccination even at this later age (e.g. if it found to be harbouring another disease or co-infection, or other reason for potential immunocompromise) then vaccination should again be repeated up to 20 weeks of age, or once the pup is recovered from the other disease that could be resulting in immune suppression that could inhibit or reduce efficacy of vaccination. Animals should wait for 10-14 days after their final ‘puppy booster’ vaccination before being allowed into an environment at-risk for CPV.

Recommended vaccination protocols for puppies in a CPV outbreak:

1st vaccination: 6-8 weeks of age
2nd vaccination: 10-12 weeks of age
3rd vaccination: 14-16 weeks of age

To reduce the risk of the MDA interference window, puppies may also be vaccinated every 3 weeks, from 6 weeks of age.

e.g. 6 weeks, 9 weeks, 12 weeks & 15 weeks of age.

Keeping pups and immunocompromised dogs safe during a Parvo epidemic

During outbreak conditions, pups or dogs that are deemed unlikely to have immunity against CPV, including those not yet fully vaccinated, should not be allowed in the environment where they may be exposed to the virus. Until they are fully vaccinated, newborn pups should be kept at home, ideally in a room that can be disinfected with bleach first (e.g. bathroom or laundry) and people should remove their shoes before entering this room, to reduce the risk of carrying the virus in on their shoes. Pups should be isolated from animals that may go outside, as these animals may carry the virus on their paws. Farm dogs that only live ‘on farm’ but that are not recently revaccinated are at risk during CPV outbreaks, and are often mentioned as casualties of CPV even if they do not leave the farm. This is due to the ease that the virus can be carried on to the farm by humans, other animals, car tyres etc. These farm dogs should be revaccinated in outbreak situations.

Annual revaccination

During Parvovirus outbreak conditions, annual revaccination of all dogs that have not been vaccinated in the last 12 months or longer, is recommended. During Parvovirus outbreak conditions, the risk of vaccinated animals contracting CPV is heightened. While vaccines against CPV are highly effective, vaccination does not guarantee immunity in every patient due to a range of patient-factors that could result in inadequate seroconversion or below-optimum immunity after a previous vaccination. While the risk of vaccination failure in normal circumstances is very low, during an outbreak of CPV, vaccination efficacy is tested, and failures can occur. Therefore re-vaccination of patients is highly recommended.
Risk of Parvovirus in Urban vs Rural areas

In a recent Australian epidemiological survey, more than twice as many cases of CPV were reported in rural or regional areas, compared to urban (city) areas. A greater proportion of rural cases are younger, entire dogs, compared to their city counterparts. Age and vaccination status (unvaccinated) were significant predictors for cases in rural areas. It has been long suggested, but never proven until now that rural and regional areas are at a higher risk than city areas for CPV, and this means that greater caution needs to be taken to shelter not-yet-immunocompetent animals from this virus, in these areas, especially during disease outbreaks.

Efficacy of CPV vaccine strain

There is no evidence that CPV vaccine strain plays a role in vaccine failure. In Australia, 2 main current CPV strains have been identified (CPV-2a and CPV-2b) where CPV-2a is recognised as the predominant strain. All vaccines are recognised as providing cross protection against the strains of CPV. Vaccine failure resulting in clinical disease occurs primarily due to MDA-interference in young dogs, and secondarily due to patient-factors causing sub-optimal immunity, or co-infections exacerbating disease signs.

Canine Parvovirus and Cats

CPV2a, CPV2b, and CPV2c strains are all able to infect cats and can cause clinical illness - though the significance of CPV epidemiologically in cats is unreported. Symptoms of CPV infection in cats are similar to those in dogs, and similar to Feline Panleukopenia infection. FPV vaccination in cats will provide cross-protection against infection with CPV and it is recommended that in a CPV outbreak that cats are also kept up-to-date with their annual FPV vaccines. The extent of efficacy of FPV vaccines against the newer CPV strains in cats is a topic of current scientific research.

Reporting of Cases

Australia’s national disease surveillance system for companion animals is Disease WatchDog, and all veterinarians are asked to log cases of CPV at www.DiseaseWatchDog.org in order that outbreaks can be quickly identified, and so that the media and the community can be alerted. Veterinarians can register for free access to disease maps, and cases can be logged easily in a matter of minutes each month, or each week.

Media and Awareness

As well as logging cases of disease on Disease WatchDog, veterinary clinics are encouraged to contact the local media (e.g. local newspaper), the AVA, and to post on social media when they see disease outbreaks or increased numbers of cases. Only by raising awareness of disease cases and outbreaks are people made aware, whereby they will see the need to preventatives or early action when they suspect a case.
References:

2 Feline Vaccine Guidelines from the Advisory Panel on feline vaccines, 1998. Feline Practice, 26 (30); 14-16


