Keeping them healthy in captivity – concepts in quarantine for wildlife in care

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Abstract
As carers, we understand that many aspects of captivity are stressful. The consequence of this stress is that wildlife in care is more susceptible to acquiring infections – bacterial, viral, parasitic or protozoal. Some infections will have been transferred directly from carer to animal. The animal is then released with these infections into a wild environment and the potential exists for the transfer of disease to otherwise healthy individuals in the population.
This presentation looks at how to reduce the transmission of disease from rescue to release. The aims of the presentation are:

1. To inform the carer on how to keep the wildlife in their care healthy,
2. To be able to identify clinical signs in an animal that may indicate disease
3. To understand the impact that poor quarantine measures can have on the very populations that we hope our patients become successful members. By lack of consideration around release, we risk decimating the very species that we love and admire.

Simple measures such as quarantine of new arrivals, hand-washing, cage cleaning and timely veterinary assistance will be addressed as tools to help maintain the good health of wildlife in care.

Introduction
Captivity is stressful. Wildlife care brings individuals into an unnatural situation, where animals no longer live in their natural family groups, they are provided with food that is not their normal diet, and may be housed within sight or sound of predators, both wild and domestic. Often rehabilitation involves rearing young animals, which inherently have poor immune systems and live under the stressors of growth and social learning as well as that of captivity (Lafferty & Gerber). It is important to realise that it may be as a consequence of time spent in our care, where the issues of stressors are not addressed, is going to impact upon the individual's survival upon release. Diseases acquired during rehabilitation may only become expressed once the animal has been released into the wild population.

Transmission of disease
Disease can be transmitted in a variety of ways. The three key methods are access to discharges, parasites or indirectly through the carer (NWRC, 2000). The method of transmission may depend on the infective organism – viruses are more likely to be obtained through ingestion or inhalation of discharges, whereas, an external parasite may need to be physically transmitted by direct contact with the animal or the crusts containing the parasite.

One key agent of transmission is you, the wildlife carer. Your clothes and hands may be the common factor that goes from one animal to another. The importance of hand-washing cannot be emphasised enough. It should be performed before food preparation, after cage cleaning and when working with sick animals. Alcohol hand-rubs should be used in between animals, for example when feeding pouch young.

CASE STUDY: a wildlife carer was raising seven orphaned parrots belonging to two species. The parrots were all housed together in one box. The carer was busy and made up a bowl of hand-rearing mix which was taken out of the fridge, reheated, used for feeding and replaced back into the fridge for the next feed. Spoon feeding was performed using one spoon which was used to dribble feed into the mouth of the first bird and the put back into the mixture, stirred around and then used to feed the next bird. One bird was presented for crop stasis after another had died the preceding day. All birds were stunted for their stage of development. A bacterial gastroenteritis was diagnosed. The bacteria had the shape and size of *E coli* on a gram stain. The likely route of transmission was the ingestion of infected hand-rearing mix – from the food or the spoon.

Clinical signs of sick wildlife

The clinical signs of wildlife that may be carrying a disease which will make others sick includes those not showing any symptoms at all. Reasons for this include the concept that many diseases have an incubation period - i.e. it will be several days or weeks before the animal shows signs of disease. It may also be that the animal is a carrier – i.e. it is shedding the disease while living 'in harmony' with the disease, but the disease may have the ability to make a young, naïve animal sick.

If an animal is showing signs of disease, then these can include:

- Gastrointestinal: diarrhoea, vomiting, presence of parasites in the faeces;
- Respiratory: discharge from nose or eyes, coughing, sneezing;
- Neurological: head tilt, blindness;
- Dermatological: abnormal feathers, feather loss, hair loss, open wounds, presence of external parasites.

Good record keeping and performing daily examinations (even if they are done at a distance) can help to identify whether animals may be showing signs of disease.

Quarantine

Quarantine is the concept of isolating all new arrivals from others until it is demonstrated that the individual is free of disease. Animals that either have or are suspected of having a disease are housed separate to other animals – this may be a separate room to where the animals are usually housed. It is ideally a separate airspace, and would have its own cages, bedding and bowls. Quarantine is the most effective tool to prevent the spread of disease. It does not require diagnostic testing, but simply an enclosure to house the animal by itself. During the time in quarantine, the animal is examined for clinical signs that may indicate disease.

The question remains – how long should an animal be quarantined? This is of particular concern amongst hand-reared young where early socialisation prevents imprinting onto humans. The time will vary with species and circumstances, such as aggression in that species, or its biology: solitary vs gregarious.

- Animals from different areas should be reared in separately, and an attempt to get the animal to a wildlife rehabilitator in that region must be made.
- Young animals, such as possums, may be housed for 2-3 days separately until it is determined that they are eating and toileting before they are housed with other possums of the same/similar weight.
- An adult bird, such as a parrot or Kookaburra is likely to spend the entire time in rehabilitation by itself, i.e. is in quarantine for the duration.
- A blue tongue lizard would be housed by itself during rehabilitation.

Potentially, diagnostic test such as examination of the faeces for parasites could be performed. Captivity is likely to increase the number of parasites present in the animal, thus tipping the host-parasite relationship towards disease (Vogelnest, 2008). Other species, such as the koala, may

be tested for Chlamydia or retrovirus. A suitable time for health screening is in the weeks prior to the animal is placed into a pre-release enclosure.

CASE STUDY: Eastern grey kangaroo joeys are screened for coccidiosis and worms one month prior to going to a pre-release enclosure. They may be treated for external/internal parasites with a topic/subcutaneous ivermectin product a week prior to transfer into the new enclosure. They would be vaccinated against clostridial disease with vaccination booster given at least one month prior (i.e. start vaccinating two months prior to transfer – at the latest).

The importance of hygiene

While in quarantine and care, several steps can be taken to keep animals healthy. Again, this relates to keeping the enclosure and food items as clean as possible.

Actions to keep sick and injured animals as healthy as possible include:

- Use disposable substrates, such as newspaper. Replace between animals;
- Clean food and water bowls daily;
- Replace water daily;
- Ensure sufficient ventilation – a minimum of 6 air changes per hour are needed;
- Disinfect cages between animals;
- Cages are cleaned daily and uneaten food and faeces are removed;
- Food is prepared and stored hygienically;
- Aquatic species (freshwater turtles) are housed where water quality is monitored and maintained.

A study of American wildlife rehabilitators indicated that only 1/3 of carers are cleaning cages daily, and only 1/3 of carers are cleaning cages between animals. One third knew the type of disinfectant used, one third did not know what they used (Saito & Shreve, 2005). This study has not been repeated in Australia. Failure to perform the basic, necessary act of regularly cleaning an animal's cage is tantamount to neglect.

Procedure for cleaning cages (Fowler, 2012)

- It can help to remove the animal from the cage and place it in a carry box.
    - This enables easier cleaning, prevents escape and stress to the animal.
    - At this point in time, the animal may also be weighed, medicated and fed.
- Consider wearing personal protective equipment: rubber gloves, and a mask (for asthmatics or those at zoonotic risk).
- Newspaper is a suitable lining for cages. It should be changed daily. When removing the paper, roll it so that food and faeces are collected without raising much dust.
- Use soapy water to remove faeces, uneaten food and discharge from the cage walls and floor.
- Wipe clean with hot water and dry.
- Then spray the surface with a disinfectant made up to the correct dilution. Examples include: bleach, or F10 SC®**.**
- Wipe down surfaces with hot water afterwards.
- Dry thoroughly after cleaning with a cloth.
- Replace paper, furniture and bowls.
- Replace or clean all perches and other furniture from one animal to the next.
- Remove faeces and uneaten food daily.
- All food and water containers are washed in detergent daily – this means you need two sets for each cage! One set that is being used while the other set is being washed and dried.
- Replace the animal back into the cage once it is weighed and medicated.

Types of disinfectants
It is pertinent to understand that not all disinfectants are created equal. Consideration to their spectrum of action, cost, duration of application, side effects should be made when choosing an agent. A wildlife carer may have different disinfectants: one for food items (bleach or F10) and another for spraying cages (quaternary ammonium compound, F10).
Some of the different disinfectants are tabled below with their actions, advantages and disadvantages.

Table 1: Types of Disinfectants

Agent	Action	Contact time (min)	Advantage	Disadvantage
Chlorine (bleach)	**G+/G- bact, virus, protozoa**	**10**	**Cheap, relative low tox, broad spectrum**	**Irritate mucosa**
Phenols (triclosan)	**G+/G- bacteria, some virusees**	**10**	**Not inactivated by organics**	**Corrosive, odour, irritate skin, not get some virus**
Quaternary ammoniums (pine-o-cleen)	**G+ bacteria**	**10-30**	**Low toxicity, non-corrosive**	**Irritate skin, not get G- spore, virus**
Iodine	**G+/G- bact, some virus**	**10**	**Change colour when exhausted**	**Tarnish metal, not get spore, virus**
F10	**G+/G- bact, virus, protozoa**	**10**	**Non-irritant, broad spectrum**	**cost**

Order of treatment and care
When handling multiple animals, rehabilitators should start with the youngest and healthiest and finish with the oldest and sickest to reduce the risks of disease transmission. The challenge is to be able to fit a changing order of treatment into the routines that most carers have. The recommended order does not mean that animals miss out on treatment or feeds, but attempts to highlight that disease can be accidentally carried to healthy animals. It may be that a better management of sick or young animals is that they are taken to carers who may only care for that age group, or have few animals and can thus put more time into the sick individual.

The dangers of overcrowding
Overcrowding of rehabilitated animals remains a major problem of great concern, but is not recognised by carers in general. There are simply insufficient large enclosures, such as aviaries or pre-release enclosures in the carer system. There appears to be a failure amongst wildlife carers to recognise that crowding many animals in a small space promotes disease. These small enclosures directly reduce the opportunity for that animal to exercise sufficiently to gain adequate fitness for release. While all state government agencies have moved towards recommending minimum cage sizes for wildlife, carers themselves continue to justify their small enclosures, rather than taking on board the recommendations to improve the survivability of the animals in their care. Until attitudes change, overcrowding will remain an ongoing reason for deaths in care, and reduced fitness (and thus survival) upon release.

CASE STUDY: carer presented sick Tawny frogmouth to the vet. It was in pre-release aviary, 4 x 2m with one high perch 2m long. Eight young tawny were placed in the aviary. A 300g bird needs 30cm distance between it and the other birds. Two had died before this bird was presented. There was no cleaning of perches or floor of the enclosure while these birds were present (for 4 weeks at this point). Faecal floatation showed heavy coccidia burden. Coccidiosis is commonly seen in young, growing animals in overcrowded, dirty situations.

Control of pest and domestic species

There are many species capable of carrying disease that can impact upon wildlife. Rodents can contaminate grain and hay with urine or faeces. They may carry a range of diseases (*Salmonell*a, *Leptospires*, encephalomyocarditis virus) that potentially could affect wildlife. Other species that could impact wildlife are flies and mosquitoes which could act to carry diseases such as malaria or pox between individuals. Rodents and insects can be baited or trapped.

Pet dogs and cats can carry *Echinococcus granulosus* (hydatid disease) and *Toxoplasma gondii*, respectively. Contamination of browse, grass or hay with faeces may be involved in the transmission of these diseases to susceptible wildlife. Other possible pathogens carried by pet dogs include *E coli*, *Campylobacter*, sarcoptic mange, and fleas. Cats also transmit *Pasturella*, as well as fleas.

CASE STUDY: a young magpie was brought into care. It did not appear to have any injuries and so, was not hospitalised in intensive care cage, but placed immediately into an aviary with three other young magpies. Lumps in the corner of the mouth were noted when another carer came to visit two days later. Magpie pox was suspected and confirmed upon examination by a vet. The magpie was removed to a mosquito proof enclosure. Unfortunately, the other magpies developed similar lesions within the next two weeks.

Control of wild animals accessing animals in care

Wild animals may access the individuals that we have in care. Wildlife rehabilitators should remember that we live within the territories of the existing wild populations. The most likely way that wild animals come to the enclosures and contact is increased beyond an occasional access is by support feeding of already released animals. This artificially increases the number of animals using the yard – and is another example of overcrowding around a resource. It is advisable to not provide ongoing support feeding in form of pellets, fruits or seed. Do not have bird feeders in the yard to attract birds. Animals should be released back to their original location, rather than soft-released from the rehabilitator yard. Failure to do so leads to dependency upon the food and these animals access the cages where other are increasing the risk of disease transmission between the wild and captive animals.

CASE STUDY: wildlife carer released from home and continued to feed released birds from bird feeder. Wild birds had access to roof of pre-release aviary and were seen to defaecate into the aviary. One year with higher rainfall, four of the five rosellas in the aviary died over a two week period. Sneezing and diarrhoea were noted in the days prior to death. Necropsy of one of the birds showed signs typical of psittacosis.

Impact of disease on wild populations

Two diseases are federally listed as threatening processes to wildlife: Psittacine beak and feather disease and Chytridiomycosis in frogs. These diseases have taken species to extinction and threaten others. The impact of a wildlife carer releasing animals with these diseases can be possible local extinctions, especially with chytrid in frogs (DECCW, 2008). We cannot underestimate the seriousness of the implications of our release of an individual upon the population that it enters.

Diseases that are already present in a population do not pose a risk if the individual is returned to that population. In other words, it is essential to return animals to their original location (or within close proximity) to minimise the spread of parasitic, viral and bacterial disease to new populations (NWRC, 2000). Introducing an animal from outside the areas, as occurs with endangered species reintroduction programs can result in the new animal being naïve to the diseases present in the population, and succumbing to those diseases (Viggers, 1993). Or, the individual brings in new disease to the population which then impacts upon the population.

CASE STUDY: A captive bred population of Brushtail rock wallabies was found to carry a strain of Macropod herpesvirus. They were to be released into a wild population 100km away. Testing was undertaken of macropods in the release area to determine which strain of Macropod herpesvirus was present locally prior to the release of these individuals. Failure to determine whether herpesvirus was present may have resulted in the death of the remaining population of Brushtail rock wallabies.

Conclusion

Some of these case studies are real, other are simply hypothetical cases waiting to happen. It is critical that our actions as wildlife rehabilitators do not affect the health of not only the animals in our care, but also the wild populations. It is incumbent upon carers to undertake regular training to understand diseases and to learn to recognise potential clinical signs that might indicate disease. We need to understand that captivity is stressful to wildlife. Application of basic hygiene such as providing clean food and water, hand-washing and cleaning cages will reduce the transmission of disease. Quarantine is the key to preventing the transmission of disease.

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