

INFECTIOUS DISEASES IN SHELTER SITUATIONS AND THEIR MANAGEMENT

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Synopsis

In shelter situations, infectious diseases are difficult to prevent and control, thus, they spread quickly (Möstl et al., 2013). In addition, shelters are unstable biological environments; not only are disease outbreaks frequent, but new pathogens may emerge or virulent variants of endemic pathogens may occur, as a result of rapid transmission cycles and consequent evolution and selection of infectious agents, such as viruses and bacteria. The virulent systemic feline calicivirus infection is a case in point (Pesavento and Murphy, 2014).

The ABCD guidelines describe the most important factors to minimise and/or prevent the spread of infectious agents (Möstl et al., 2013). These include housing in individual sections (quarantine pens for incoming cats, isolation facilities for sick or potentially infectious cats, separate accommodation for healthy, FIV- and FeLV-negative cats, for pregnant and lactating queens and their kittens), testing for infectious agents, hygiene measures and stress reduction.

This guideline considers only rescue shelters, although the hygiene aspects will also apply to other situations. ABCD recognises that there is a wide variation in the design and management of shelters, which largely reflects local financial constraints. The guidelines have been written with this diverse audience in mind; they point to the ideal situation, and suggest compromise where this ideal cannot be attained. Furthermore they focus on recommendations with regard to prevention and control of infectious diseases.

Definitions

- Rescue shelter: where cats are kept temporarily until a new guardian is found or euthanasia performed. ABCD emphasises that keeping cats in shelters should be avoided whenever possible. Where other arrangements can be made, cats should not enter rescue shelters. This is a reflection of the inevitable stress and risk of infection associated with movement to this type of accommodation. However, where necessary, good practice should be adopted to minimise these side effects.
- Boarding catteries: where cats are put temporarily while their guardians are on vacation or business
- Multicat pet households: where intentionally more than one pet cat is kept
- Cat sanctuaries: where rescued cats are kept until they die
- Breeding catteries: where cats are intentionally bred
- Trap, neuter and return cat colonies: where cats roam freely, with or without permanent carers

Focus on the problems

In shelter situations, infectious diseases spread frequently and quickly; they are difficult to prevent for the following reasons:

- ✓ In many cases, all incoming cats are accepted.
- ✓ Cats may be persistently / latently infected with infectious agents.
- ✓ Newly accepted cats reside alongside long-term residents.
- ✓ Often a no-kill policy is enforced.
- ✓ Stress, poor nutrition etc. facilitate spread of infectious agents and development of disease.
- ✓ Shelters are often short of money, resulting in crowding, inadequate hygiene and vaccination, and no testing for infectious diseases.
- ✓ Persons who work in shelters are highly motivated but usually untrained in hygiene and disease management.

A preventive management program should be implemented by the local veterinary surgeon that considers possible routes of infection and keeps the circulation of pathogens as low as possible. Measures include the regulation of housing conditions, quarantine, good husbandry, testing for infectious diseases, vaccination, good hygiene management and stress reduction.

Housing recommendations / Accommodation

Good building design can aid infectious disease control. Compartmentalisation of the shelter into individual sections can facilitate containment of a disease outbreak, should it occur. In general four separate areas are required:

- a quarantine area for incoming cats,
- isolation facilities for sick or potentially infectious cats,
- accommodation for healthy, FIV and FeLV negative cats,
- accommodation for pregnant and lactating queens and their kittens.

Quarantine area for incoming cats

In state-of-the-art shelters, all cats are essentially in quarantine. Under less than ideal conditions, cats should be kept in quarantine for a minimum of 3 weeks (considering cats incubating FPV or FCV infections or reactivating latent FHV infections, and while their vaccination becomes effective). Considering the risk of FIV and FeLV infections, where all incoming cats are routinely screened (e.g. in high risk areas), ideally quarantine should not be shorter than 6 weeks (the period for FIV seroconversion and for becoming FeLV antigenaemic may be long). Cats showing any signs of infectious disease should be moved immediately to the isolation facilities.

Isolation facilities for sick or potentially infectious cats

Cats showing signs of infectious disease or testing positive for e.g. FeLV must be isolated. Isolation areas have to be strictly separate from the quarantine area and other residents, preferably in a separate building.



Fig 1: Outdoor area adjacent to accommodation for healthy cats ("Tierschutzkompetenzzentrum Klagenfurt", Austria; kindly provided by Dr. Marina Zuzzi-Krebitz and MMag. Alexander Zuzzi)

Accommodation for healthy, FIV and FeLV negative cats for adoption

Rooms housing small groups of cats (testing negative for FeLV and FIV infections and vaccinated against FPV, FHV and FCV) that have access to an adjacent outdoor area are ideal (Figure 1). Fencing should ensure that interactions with other animals (including birds) are prevented. Cats must have access to fresh water and shade, as well as protection from rain and cold weather. To facilitate adoption, potential new owners should be able to view the cats, but windows for viewing should be of perspex or glass, not wire mesh.

Accommodation for pregnant and lactating queens and their kittens

Pregnant and lactating queens and their litters should be housed in a separate area. Each queen needs a separate pen, and no other cat should be allowed to share it. Ideally, these cats should not be housed in a shelter but rather outside of the shelter in foster families/homes organised and facilitated by the shelter.



Washroom at the entrance to units ("Tierschutzkompetenzzentrum Klagenfurt", Austria; kindly provided by Dr. Marina Zuzzi-Krebitz and MMag. Alexander Zuzzi)

Facilities and equipment

The entrance to each section should have facilities for hand washing and places for clean overalls. Ideally there should be washrooms where the carers can wash hands (Figure 2). Hand and equipment disinfectants should be easily accessible. Overshoes should be provided, or a boot bath of disinfectant should be placed at the entrance/exit of the quarantine area and isolation facilities. Equipment for cleaning, disinfecting, feeding etc. must be available for each area and must be kept strictly there. To facilitate identification, different colours for food and water bowls, litter trays, beds etc. specific for each area should be used.

Corridors should have non-porous surfaces with easily disinfectable, rounded corners. Floors of the indoor facilities and furniture should be easily cleaned (e.g. no carpets allowed).

Each room for cat accommodation must include a sufficient number of litter trays: one tray for each adult cat plus one extra. Litter trays should be placed away from food and water bowls. Also sufficient food and water bowls, beds, scratching posts, toys and hiding areas should be provided.

The use of cages should be restricted to special circumstances, like medical indications (e.g. during quarantine period, after surgery or injuries, in the isolation facilities); regional legislation about the adequate size of cages must be considered.

In all accommodations, attention must be paid to provide a suitable environmental temperature (10-29 °C), good air quality (10-12 exchanges per hour), prevention of noise and other stressful factors (Hurley, 2005; Geret et al., 2011).

Animal density

During evolution, cats have assumed a solitary lifestyle. Animal density in rescue shelters should therefore be kept as low as possible, as the prevalence of pathogenic micro-organisms and consequently infectious disease is correlated with population density and size. In ideal shelters, cats are housed individually or only together with cats from the same original household.

Groups should be kept stable, as far as this is achievable with the turnover / adoption of cats by new owners. Kittens should be kept in a special quarantine facility together with only their litter mates, and without contact with adults other than their queens. High animal density not only increases the risk of infectious diseases, but may also produce stressful situations. No formula for the recommended number of cats per group can be given, as additional elements like environmental enrichment and the quality of care may have a great influence.

With respect to the management of infectious diseases, groups should be kept as small as possible. Coronavirus infections for example occur at significantly higher rates in multicat situations as compared to single cat households. In catteries and shelters with more than 6 cats, this infection is virtually always present (Pedersen, 2009). ABCD recommends keeping groups of 3 or less cats per room (Addie et al., 2009), otherwise the risk of cross infection increases dramatically.

Standard of care in the management and prevention of infectious diseases

Various pathogens affecting felines are ubiquitous and frequently introduced into shelters. In a rescue shelter in Belgium, Zicola et al. (2009) found prevalence rates for feline herpesvirus and feline calicivirus of 20.1 and 33.1 %, respectively. In the UK, the FCV prevalence is approximately 30 % in shelters (Radford et al., 2001; Coyne et al., 2007). Pathogens may be shed intermittently or continuously over prolonged periods of time (also subclinically). In the shelter environment, rapid and efficient spread may occur as soon as the first week after introduction of incoming cats (Pedersen et al., 2004).

Careful observation and examination of the health status of cats in a shelter, especially of new arrivals, and testing procedures are essential in order to detect infectious (and other) diseases at an early stage.

Care workers should be instructed about the risk of zoonotic infection (especially rabies; in endemic areas stray cats should always be approached with caution).

Standard of care for incoming cats

Each incoming cat should receive a full health check by a veterinarian.

Cats should be specifically checked for gastrointestinal, respiratory, and dermatological problems, as these are commonly contagious and should be diagnosed and treated immediately. Dermatophytosis is the most common contagious and infectious skin disease of cats and very difficult to eradicate in catteries and shelters (Frymus et al., 2013).

Incoming cats should be dewormed and treated for external parasites. In areas endemic for heartworm, cats aged more than 2 months should be placed on a prevention regime. Testing is strongly recommended and is based on both antigen (cats older than 5 months) and antibody (cats older than 2 months) detection. However, where a "do not test policy" applies in shelters with limited financial resources, chemoprophylaxis can be safely administered.

Every cat in a shelter should be neutered.

Details of all medical interventions should be recorded and stored.

Arrival in a shelter is always stressful; stress should be minimised to avoid exacerbation (e.g. of coronavirus infection leading to FIP) or reactivation (e.g. of a latent FHV infection) of infections.

Cats should not be euthanised, unless they are in a moribund, terminal condition. If appropriate treatment is unavailable and cats are suffering, euthanasia should be considered for humane reasons.

ABCD does not recommend the euthanasia of healthy FIV or FeLV infected cats, unless they cannot be kept separate from the rest of the population.

Standard of care for cats after having passed quarantine

Active efforts should be made to improve the chances of re-homing shelter cats as quickly as possible. Gouveia et al. (2011) showed that lengthy periods spent in a shelter may be associated eventually with decreased activity levels, decreased food uptake and a greater tendency towards antagonistic behaviour. Additionally a shorter turnover time contributes to a reduction in circulating pathogens (Hurley, 2005).

Cats that are not re-homed should receive regular health checks at intervals recommended by their veterinarian. Special attention should be paid to signs of stress, frustration or behavioural changes.

Regular deworming and flea treatment (as well as heartworm prevention in endemic areas) should be performed.

Revaccinations should be performed, and a complete record of the medical history should be kept.

Considerations of euthanasia have been mentioned; a long-term stay in a shelter may have implications on quality of life. The establishment of an Ethics Committee can be helpful.

Testing recommendations for incoming cats

Testing for retrovirus infections

The decision to test all incoming cats for FeLV antigen, (ideally also for proviral DNA to identify regressively infected cats) and FIV antibodies rests with the individual shelter, but is essential during the quarantine period in shelters where contact between cats cannot be prevented. Especially in areas with high retrovirus prevalence, cats that are FeLV antigen- and/or FIV antibody-negative at first testing should be retested six weeks later, whilst remaining in quarantine. This time period is necessary to reduce the risk of missing a recently infected cat, since it may take up to six weeks (or even longer) after FIV infection for antibodies to become detectable (Sellon and Hartmann, 2006), and 4 to 6 weeks to test positive for FeLV antigen (Hartmann, 2006). RT-PCR detecting FeLV RNA is highly sensitive testing positive already one week after exposure.

A positive FeLV antigen test indicates that the cat is FeLV-infected and is shedding virus, with great probability. However, false-positive results may occur, and immediate retesting of positive antigen tests by PCR for proviral DNA should be performed, especially in areas with low FeLV prevalence. In addition, a positive FeLV antigen test may result from either a progressive (persistent viraemia) or a regressive infection (transient viraemia). Cats with regressive infection are considered protected against FeLV infection once they overcome the initial viraemia; they do not shed FeLV, but remain provirus-positive with some risk of reactivation. To differentiate these two outcomes, retesting at a later time point is recommended (for details see the ABCD tool for "FeLV diagnosis"). If cats with a positive FeLV antigen test cannot be quarantined until retesting, these animals should be considered infected and as shedders.

Kittens up to 6 months of age might still test positive for FIV due to maternally derived antibodies, although they are probably not infected (Levy et al., 2003). Therefore, kittens should be kept in quarantine or rehomed and retested at 6 months of age.

Both retroviral infections may persist for long periods of time without causing clinical signs. FeLV is shed in large amounts, especially via the saliva, and may be efficiently transmitted. Testing and preventive measures minimise the risk of FeLV introduction into the shelter. While friendly social interactions suffice for FeLV transmission, FIV is spread mainly by biting. Especially in socially unstable groups under shelter conditions, the risk of FIV and FeLV transmission is high. FeLV- or FIV-positive cats should not be housed together with retrovirus-negative cats. FIV infected cats can be housed together, and FeLV infected cats can be housed together, but they should not be mixed. Their immunocompromised status must be considered: they are particularly susceptible to infections, and their health status must be monitored. It should be kept in mind that some secondary infections have zoonotic potential.

Healthy cats with either retrovirus infection should be adopted out as soon as possible, but only to indoor-only, single-cat households. Prospective owners have to be informed about the existing infection and the consequences (potential recurrent illness, shortened life expectancy, responsibility to avoid virus spread to other cats).

Testing for other infectious agents

The ABCD does not recommend testing incoming cats for other infectious agents, including FCoV, FCV, FHV, FPV, lung worms, unless there are specific clinical signs. We also do not recommend testing for intestinal parasites but rather deworming all incoming cats. In cases where a feline dermatophytosis outbreak is suspected, a shelter-specific outbreak management plan is needed. Detailed information is described by Newbury and Moriello (2014).

Vaccination recommendations

After clinical examination, each healthy cat aged 6 weeks or older (with rare exceptions, e.g. if unambiguous documentation of vaccination is provided) should be immediately vaccinated against FPV, FHV and FCV infections. In the face of an outbreak, vaccination starting at 4 weeks of age may be considered. Modified live vaccines (MLV) for parvovirus should be used because of their rapid onset of immunity (Greene and Addie, 2006). For FCV, inactivated and MLV products are available; because of the high turnover rates in shelters, MLV are preferred, as protection develops more quickly. However, in immunocompromised cats, FIV- or FeLV-positive cats, in cats with chronic disease (if vaccination is indicated at all) as well as in cats with chronic stomatitis and FCV infection, MLV should be avoided.

If FPV, FHV and FCV outbreaks occur in a shelter, passive immunisation can be performed using immunoglobulin products, where available.

The vaccination course should be continued (if the cat has not been re-homed in the meantime) at 3-4 weekly intervals until the age of 16 weeks. When disease occurs during this time period in the shelter, more frequent vaccination (every 2 weeks) should be considered. For cats, older than 16 weeks, a single dose of a FPV MLV and two doses of FHV and FCV vaccine, 2-4 weeks apart should be administered.

Adult cats with a complete vaccination history (including the vaccination one year after the kitten vaccination course) should be revaccinated annually against FHV (Thiry et al., 2009), FCV (Radford et al., 2009) and against FPV at intervals of three years, unless special conditions indicate otherwise (Truyen et al., 2009).

Cats should not be rehomed earlier than 48 hours after vaccination in order for any side effect to be detected before joining the new owner.

For sick or pregnant cats, the decision has to be taken individually, but vaccination is recommended whenever justifiable and as soon as possible. Pregnant cats should never receive a live FPV vaccine. Passive immunisation with FPV antiserum (or anti-CPV-2 canine globulin) may be considered in these cases, where available.

New owners should be informed about the pet's vaccination history and when the next booster will be due. A vaccination certificate should be provided.

Hygiene recommendations

Hygiene is the most important aspect of infectious disease prevention. The measures should ensure that contact between shedders of infectious agents and susceptible animals is avoided as far as possible. New infectious agents and diseases are emerging continuously and are impossible to predict. Maintaining high levels of hygiene, and having them enforced by well-trained staff, will prevent such diseases from spreading and becoming catastrophic. Lack of hygienic measures may have disastrous consequences; to give an example: outbreaks of virulent FCV in veterinary surgeries resulted in their closure for days to weeks.

It is essential to continuously train and coach the staff, to re-evaluate the vaccination strategy and to enforce the practice routines with infectious disease. As an example, the resistance of infectious agents in the environment must be considered. Parvovirus and oocysts of *Isospora*, for example, can survive in the environment for months to years. Indirect transmission is a major risk in any environment with a high turnover of animals. Indeed, Clay et al. (2006) have shown that FCV can survive for 3 days on telephone buttons and receivers, and 1-2 days on computer mice. Therefore, careful planning is required for the decontamination of such objects, as well as disinfecting hands, the consulting room table and the routine cleaning between consultations in the veterinary surgery.

The spread of infections and disease may be controlled by separate accommodations and quarantine, movement control, hygiene procedures of care workers, barrier nursing, disinfection, vaccination, and reduction of animal density, as detailed below. In addition, chronic or recurrent stress should be minimised to keep animals (and people) healthy.

Movement control

Movement control has to be considered between the areas described above, in order to prevent the spread of infectious agents to susceptible animals through direct contact or indirectly, via persons or equipment.

During the quarantine period cats should not be moved to the accommodations for healthy, FeLV and FIV negative cats. Cats showing signs of infectious disease, like upper respiratory tract signs, or testing positive for FeLV or/and FIV should be transferred to isolation facilities.

In the quarantine and isolation areas, individual pens should be used.

If possible, interactions should only be allowed between cats originating from the same household.

Hygiene procedures for care workers

To prevent indirect transmission through persons or fomites, protocols are required that detail the hygiene procedures to be followed by care workers.

Care workers should not wear street clothes in the facility. Professional clothing should be easily cleaned or disposable (including shoe covers, gloves etc.). In the quarantine and isolation areas, protective clothing (overalls, aprons, gloves, footwear or boots) should always be used and changed (preferably disposable) or at least disinfected between cats. Clothing should never be taken outside the respective

area. If overshoes are not used, footbaths should be available. However, poorly maintained footbaths may contribute to the distribution of pathogens - they must be cleaned and changed at intervals that ensure that the disinfectant is always working. The manufacturer's instructions have to be followed. Disposable footwear is always preferable.

For the healthy cat accommodation, care workers may use the same apron / overall for one unit.

Each area should be equipped with its own set of food and water bowls, litter trays, bedding, cleaning equipment, rubber gloves, footbaths, overshoes etc. It is helpful to have these in different colours to avoid confusion.

Access to quarantine and isolation areas should be restricted rigorously. Ideally, different persons should take care of different groups of cats. Otherwise barrier nursing processes should be strictly followed.

A disinfectant hand wash should be used between handling individual cats, before and after breaks, and by all visitors.

All cages and pens should be cleaned daily. Cleaning of one cage / pen / area should be completed before moving to the next one. A deep clean and disinfection should be performed when a cat is homed before the cage / pen is used for the next animal.

Barrier nursing

A routine should be established whereby susceptible 'clean' animals should be fed first and their litter trays changed first. Older, vaccinated animals should be attended to next, followed by the cats in quarantine, and finally the sick cats. The person tending the cats should not go back to the susceptible cats after dealing with those who are sick. Each cat should be provided with two sets of litter trays and bowls, so that while one is being cleaned and disinfected, the cat may use the other. Larger shelters will have separate attendants for healthy kittens, adult cats and sick cats. The most hygienic shelters will provide separate overalls, overshoes, boots or a foot bath, and rubber gloves for staff to wear when attending each individual pen.



Fig 3: Cage with separate compartment for litter tray, suitable for on spot cleaning ("Tierschutzkompetenzzentrum Klagenfurt", Austria; kindly provided by Dr. Marina Zuzzi-Krebitz and MMag. Alexander Zuzzi)

Cleaning and disinfection

Pens and cages should be thoroughly cleaned with detergent to remove organic matter before disinfection. For disinfection (especially between cats inhabiting pens), an appropriate efficacy-tested disinfectant should be used. As in shelters non-enveloped viruses such as FPV and FCV are of particular concern, only disinfectants that are efficacy-tested against these viruses should be used.

Common disinfectants known to inactivate non-enveloped viruses are, among others, based on aldehydes, peracetic acid, monopersulphate (potassium peroxymonosulphate), or hypochlorite. As alcohols and quaternary ammonium compounds do not inactivate

parvoviruses they should not be used as a sole measure. It is important to observe the correct dilution and recommended contact time. Where coccidial infections can occur, premises should be regularly steam cleaned, and disinfectants specifically tested against coccidia should be used in addition to the regular disinfectants. Pens should be left empty for as long as possible between occupants.

If foot baths are used at the entrance to or exit of the quarantine area and isolation facilities, the disinfectant used in the foot bath should be efficacy-tested against the relevant pathogens, including parvovirus.

On a daily basis, food and water bowls as well as litter trays must be cleaned thoroughly. Whenever needed they should be soaked in disinfectant for the recommended time, rinsed carefully, dried and returned to the same cat(s). Litter trays and dishes must not be cleaned at the same time in the same sink. In pens with runs and cages for healthy cats, "spot cleaning" may be considered, as long as the housing is used by the same cat (Figure 3). "Spot cleaning" means that cleaning measures are performed while the cat remains in the cage instead of moving it. Non-tracking cat litter is preferable, in order to reduce the spread of e.g. parvo- and coronaviruses.

Bedding and soft materials are either disposed of or cleaned of organic material, soaked in disinfectant and then washed in a washing machine at as high a temperature as possible. Furniture, toys and scratch-posts should be removed or cleaned and disinfected if possible.

Information about transmission and shedding of viruses is provided in Table 1, of other infectious diseases in Table 2.

Table 1

| Infection | Survival outside host | Virus shedding | Mode of transmission | Prevention of infection |
|-----------|--------------------------------------|--|--|---|
| FCV | up to 1 month (Radford et al., 2009) | continuous | direct contact (sneezed droplets) and indirect transmission | vaccination; excellent hygiene; sneeze barriers |
| FHV | 12 - 18 hours | intermittent, lasts 7-14 days | direct contact, sneezed droplets | Vaccination reduces the risk of clinical signs, but not infection; stress reduction essential |
| FeLV | minutes | continuous | direct contact essential - especially via saliva, faeces; transplacental, milk rare | test all cats before mixing them, vaccination may be considered |
| FIV | minutes | continuous * | direct contact essential - mainly biting; transplacental rare | test all cats before mixing them |
| FCoV | up to 7 weeks (Scott, 1998) | can be intermittent | mainly via faecal-oral route; indirect, through cat litter; shared litter trays, poop scoops; not transplacental | excellent hygiene, especially faeces |
| FPV | up to 1 year | usually only 24-48 hours, but can be up to 6 weeks | faecal-oral route, indirect, transplacental | Vaccination is highly recommended for all cats; excellent hygiene and disinfection |

| Infection | Survival outside host | Virus shedding | Mode of transmission | Prevention of infection |
|-----------|-----------------------|---|----------------------|--------------------------------|
| Rabies | minutes | continuous for a few days (just before and during period of clinical signs) | biting | Vaccination is very effective. |
| | | * virus load is very low during the long asymptomatic phase | | |

Table 1 - Virus transmission and shedding

Table 2

| Infection | Survival outside host | Shedding | Mode of transmission | Prevention of infection |
|---------------------------|--|--|--|--------------------------------|
| Chlamydomonas reinhardtii | only a few days at room temperature (Greene and Sykes, 2006) | in ocular secretions, usually for about 2 months, but can be much longer | mainly direct since organism is fragile; but indirect (e.g. on hands) is possible since elementary body can survive outside host | Vaccination may be considered. |

| Infection | Survival outside host | Shedding | Mode of transmission | Prevention of infection |
|--|--|---|--|---|
| B.bronchiseptica | up to 24 weeks in water and moist environment | in oropharyngeal and nasal secretions, up to 19 weeks | mainly direct and indirect from coughed aerosol | Interspecies transmission between cats and dogs is possible. Vaccination may be considered. |
| Toxoplasma gondii | years in rodents or other intermediate host; oocysts highly resistant in the environment | 2 weeks in cats' faeces | cats are usually infected by ingestion of oocyst-contaminated food and water | not really an issue in most multicat environments and probably not feasible anyway |
| Protozoa (Giardia, Isospora, Tritrichomonas) | Oocysts survive months to years in environment. | in faeces | ingestion usually | regular steam cleaning of environment; check water and food if suspected sources of infection |

Table 2 Transmission and shedding of nonviral infectious agents

Stress reduction recommendations

Stress reduction is important for overall health especially in a shelter environment. It serves e.g. to lower the risk of development of FIP from a coronavirus infection (Rohrer et al., 1993), or to avoid reactivation of latent feline FHV.

Stress results from various unpleasant stimuli, such as noise, odours, uncomfortable temperatures, unfamiliar people, animals and environments, as well as unskilled handling. Even minor changes, such as moving from one cage to another or being placed in a carrier, can be stressful for cats. Stressful events are amplified when unpredictable, or when the animal lacks the opportunity to modulate their effects through behavioural responses (Carlstead et al., 1993; Hurley, 2005). A feline stress-scoring system has been proposed (Beata et al., 2007), which may help to monitor the success of interventions. Arhant et al. (2015) investigated animal-based parameters for cat welfare, which are stable over time and reproducible by different raters. They found that increased proportions of very thin cats correlated with a higher proportion of pens with less than one lying area per cat and with a lower proportion of pens with hiding places for all cats. Poor coat condition correlated with longer mean length of stay in the shelter.

Housing

Stress is reduced above all by maintaining low animal densities. In animal shelters, cats housed at high densities or in large groups display more signs of stress than singly-housed cats. If they had not been socialised to other cats, they also experience more housing stress. Stable groups are the best option, because the arrival and departure of new animals inevitably creates stress, apart from the disease control challenge (Hurley, 2005). When keeping cats in groups, attention should be paid to social compatibility.

Providing environmental enrichment like beddings, scratch posts, toys and hiding areas plays an important role for stress reduction. High-sided cardboard boxes or easily disinfectable beds allow timid cats to hide away from view (Rochlitz, 1999; Ellis, 2009). Newly sheltered cats provided with a hiding box during quarantine had significantly lower stress levels compared to cats without this enrichment (Vinke et al., 2014). Animal handling, such as stroking anxious cats, may have positive effects, as suggested by an increase of S-IgA and reduction of upper respiratory tract disease (Gourkow et al., 2014). In facilities where both dogs and cats are sheltered, cats should be housed separately (not only to avoid contact, but also to reduce stress originated from dogs' smell or from barking).

Offering possibilities for hiding, playing and watching outside activities is important for stress reduction and general well-being (Fig 4). However, efforts at environmental enrichment must take a cat's individuality into account. What is relaxing to one cat may be stressful to another, depending on prior experience, genetics, and individual temperament (Hurley, 2005).



Fig 4: Hiding box (The Feline Centre, Langford Vets)

Pheromones

Pheromones are chemical messengers that trigger a social response in members of the same species. It has been claimed that their application to a cat's living space may provide environmental enrichment (Pageat and Gaultier, 2003). Westropp and Buffington (2004) reported positive experiences with a synthetic analogue of the naturally occurring feline facial pheromone. However, in a systematic review of the scientific literature, Frank et al. (2010) found insufficient evidence for the effectiveness of pheromones in the treatment of undesirable behaviour in cats and dogs.

Synthetic pheromones have been used in shelters with the objective to reduce stress. They are predicted to alter the emotional state of the cat via the limbic system and the hypothalamus and have been recommended for the prevention of anxiety-related behaviours, such as house-soiling (Carney et al., 2014). Horwitz and Pike (2014) have published anecdotal observations that synthetic pheromones are useful when introducing new cats into a household. However, Chadwin et al. (2017) evaluated a synthetic feline facial pheromone product on stress scores and the incidence of upper respiratory tract infection in 336 shelter cats of two animal shelters and did not find any evidence that the evaluated product had any effect on these parameters.

Epilogue

When planning to build a rescue shelter, it makes sense to consult an authority like International Cat Care (formerly the Feline Advisory Bureau) or the UC Davis Koret Shelter Medicine Program. Advice on e.g. sneeze barriers, pen construction and dimensions to minimise disease spread can be obtained from dedicated specialists. It is also helpful to visit a number of rescue shelters and animal hospitals to see what is available and what the options are.

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