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## Impacts of Shelter & Housing Design on Shelter Animal Health

### Introduction

The aim of this document is to provide information about aspects of shelter design and animal housing that are thought to have a significant impact on the physical and behavioral health of shelter animals. This information is based on scientific data, expert opinion, and/or the collective clinical impression of shelter veterinarians, especially shelter medicine specialists. Unfortunately, scientific data regarding factors that impact disease levels in shelters are very sparse. The lack of information is due to several factors including, limited available funding and staff to conduct investigations, and the complexities involved in conducting investigations given the variability that exists within and between sheltering organizations.

### Before you build: defining goals and gathering information

Early in the process of considering a new or expanded facility, it is important to carefully articulate the goals for the project. Consideration should be given to both current and future trends. A good way to start is simply by brainstorming the reasons for the new building: is the hope that animals will be healthier and more comfortable? That the new building will be more efficient and easier to keep clean? That facilities will exist to provide education for the community or shelter staff? Are there special populations that are not provided for by the current building design, such as puppies and kittens, sick animals, mothers and neonates awaiting foster care? Are shelter or rescue transfers anticipated, either as a receiving or source shelter? If so special housing considerations may be indicated. These are just some examples for goals shelters might have for a new building; each shelter's list will be different based on management philosophy, resources and challenges inherent to that particular community.

Once a list of goals have been established, some effort should be made to prioritize the goals. Most often, some compromises are required: each possible investment in the new facility should be considered in light of how much benefit it will have for the highest priority goals. Will additional adoption housing serve the shelter's goals better than an area for animals awaiting foster care or rescue? Will a huge, impressive lobby have more benefit than high quality cat housing? Sometimes shelters are built or expanded with the idea that simply expanding the space and making the environment more appealing on the surface will lead to great gains in saving lives. However, more space alone will not necessarily increase adoptions or reduce euthanasia - if quality and efficiency of the space is not improved, the results of even an enormous investment in facility expansion may be disappointing.

### Addressing the numbers

#### Intake and holding time

One important preparatory step is to define the required amount of holding spaces for individual animals at any one time. This needs to take into consideration both intake numbers and anticipated holding time per animal (legally required hold time plus time for adoption or other special holds such as for medical treatment). This should be calculated on a monthly basis; sufficient holding spaces must be provided for the maximum number anticipated for a given month (possibly more, depending on anticipated future trends, such as population growth or expanded programs). These spaces may be represented by spaces in group housing or single cages; dogs should be singly housed throughout their stray holding period, and sick animals should always be held individually.

## **Staffing levels**

The National Animal Control Association (NACA) estimates ten minutes are required to provide daily cleaning and care for one animal. Additional tasks such as laundry, general area cleaning, behavior evaluations, and euthanasia are not included. At minimum, no more housing should be built than staff time will be available for maintenance.

## **Population trends**

Historical trends in numbers of humans in the community and cats, dogs, rabbits and other species entering the shelter should be evaluated as well. In many communities, dog numbers are steadily decreasing while cat numbers are holding steady or even increasing. If possible, flexible space should be included that will allow

## **Minimizing disease transmission**

The majority of diseases in animal shelters are spread by fomites, environmental contamination, and direct animal contact. A fomite is any object that may become contaminated with disease-causing microorganisms and thus serve to transmit disease. Fomites include dishes, bedding, leashes, and, most importantly, the hands and clothing of animal care staff. Contamination of animal care staff occurs most readily when animals are handled for cleaning. It is a common misconception that the majority of diseases in a shelter setting are airborne.<sup>1</sup> This is generally not true, especially in cats. Studies have shown that aerosol transmission plays little role in the contagiousness of upper respiratory infections in cats.<sup>2,3</sup> Healthy cats housed in the same air space as sick cats remained healthy, as long as fomite transmission from the sick to healthy cats was prevented. Fomite transmission was prevented primarily by assigning different caretakers for the sick and healthy cats. Coughing or sneezing cats are unable to generate aerosols that will spread any further than 4-5 feet, while dogs are thought to be able to spread pathogens up to 20 feet.

Information from one shelter design firm stated that "aseptic conditions are a primary consideration for medical and isolation wards." This suggests that we need to worry about sanitation more once animals are already sick. However, since many shelter animals may be shedding pathogens prior to, or even in the absence of, clinical signs of illness, we need to ensure sanitary conditions in ALL animal housing areas, especially those areas housing animals that are not yet sick but that are particularly vulnerable to disease (new intakes, young animals). The aim is prevent disease, so that animals never have to enter a sick ward or isolation area.

## **Housing design to minimize fomite transmission**

Most important is that housing should be designed to minimize fomite transmission by staff, especially during cleaning. Housing systems which require that animals be handled by cleaning staff in order for cages or runs to be adequately cleaned are not recommended. For dog areas, runs with guillotine doors are essential, especially in areas designated for dogs that are newly admitted, sick, or potentially aggressive. Double sided-cages in all cat housing areas are also preferable.

Fomite transmission by members of the public sticking their fingers serially into animal cages is likely relatively insignificant. This is due to the relatively small dose of pathogens that can realistically be transmitted through brief exposure to human fingertips. Therefore, expensive or high-maintenance housing systems designed to prevent poking fingers of the public may not be worthwhile, especially if these systems compromise air quality within cages.

## **Housing design to minimize direct transmission between animals**

Shelters should have sufficient capacity for single animal housing for at least the first several days of the shelter stay. Exceptions are litters or bonded pairs that come in to the shelter together.

Of course, housing should be designed to prevent contact between animals in adjacent cages (nose-to-nose contact, feces or urine leaking from one cage to another, etc.)

Shelters must have adequate capacity for population segregation: Shelters ideally should be designed with multiple smaller animal housing areas rather than fewer larger housing areas, to allow for separation of sub-populations. It is particularly important for shelters to have facilities for segregation of the following sub-populations:

- Sick animals [respiratory disease, diarrhea, ringworm, mange, etc. and always separated by species. (Mixing sick animals of different species is a recipe for species-jumping emerging pathogens, which could pose potential zoonotic risk.)
- Animals recovering or recovered from illness
- Young animals (puppies and kittens under 5 months of age)
- Different species (dogs vs. cats, also rabbits, birds, wildlife, etc.)

Other sub-populations that may need to be separated from the rest of the population include: newly admitted animals, injured animals, animals in rabies quarantine, legally impounded animals, males vs. females, nursing mothers, feral cats, strays vs. owner-relinquished animals, and animals available for adoption vs. those not available. Uses of various segregation areas should be flexible, to accommodate changes in housing needs over time. Due to this need for flexibility, the majority of caging in shelters must be provide humane accommodations for medium- to long-term housing.

Design to allow for all-in/all-out housing whenever possible. All-in/out housing is widely used to minimize disease in livestock production, especially for pigs. In this system, all animals are generally moved into a particular housing area at once, without additional animals being continually added, and, typically all animals leave the housing area together as well. After all animals leave, the area can be thoroughly cleaned before bringing in a new group. In a shelter, it is often not possible for all animals to leave an area at once, but all-in/all-out can still be practiced if we wait for all animals to leave an area and then clean it before allowing any new ones in. In open intake shelters, it may also be difficult to prevent continual trickling in of animals into an area, but it can be practiced to the extent possible. In limited admission, fast-turnover shelters, it should be entirely possible to practice all-in/all-out housing. Because of the fluidity of many shelter populations, all-in/all-out housing will be much easier to implement if the shelter has more numerous, smaller rooms rather than fewer, larger rooms.

### **Housing design to minimize environmental contamination**

Design shelters to allow fewer changes in housing. Consider designing housing that could house an animal in the same cage throughout its shelter stay. A move from holding areas to adoption areas is usually considered a given, but may not be necessary in all shelter situations, and may be counterproductive in terms of animal stress and health. Reducing changes in housing can minimize disease transmission through environmental contamination, and can also help to prevent stress and viral shedding in cats (see below). Allow UV light exposure of housing areas, to take advantage of the disinfectant activity of UV light.

Design an intake/ initial processing areas which are easily cleaned between animals. Despite some recommendations to the contrary,<sup>4</sup> this initial intake area must be separate from areas that may be used for processing or evaluating animals that have already spent some time in the shelter. For example, animals moving from a stray holding area to an adoption area should NOT pass through the initial intake area. Animals that are being moved to euthanasia should also NOT pass through the initial intake area, nor through an adoption-staging area.

### **Heating ventilation and air conditioning systems (HVAC)**

Requirements for various air change rates to prevent disease spread are frequently cited. Examples include 6-20 air changes per hour,<sup>1,4,5</sup> and 100% fresh air exchanges every 6-10 minutes. Strict requirements for a specified number of air changes or exchanges per hour may not be critical for shelter animal health. Completely separate ventilation systems, sophisticated air filtering systems, or specific air flow patterns also may not be necessary. For animal health, especially in cats, the bottom line requirement is good air quality within animal

housing units. Specific HVAC requirements should be pursued only to the extent that they impact this bottom line. Lower population density helps maintain air quality, and fresh air or outdoor access for both dogs and cats may lessen respiratory disease.

### **Plumbing systems**

Each and every animal housing area (including public areas) should have at least one sink with a paper towel dispenser, AND hand sanitizer dispenser. Each housing area should also have at least one drain. Strong recommendations for either individual drains or trench drains are commonly made.<sup>5</sup> There is no absolute association between drain type (individual vs. trench) and level of disease. It is possible to adequately control disease in shelters with either drain type, provided that drains are well designed, appropriately placed, adequately cleaned, and properly functioning. Drains of either type that are difficult to clean or that are accessible by various animals can transmit disease. Drains absolutely should not be placed in walkway areas. When considering LEED certification, be sure that adequate disinfection will fit into the plan. For example, water reclamation systems must allow use of crucial disinfectants such as bleach or potassium peroxydisulfate.

### **Other Considerations**

It is essential to have designated area that will allow thorough and complete cleaning & drying of transport carriers. Include locker rooms for staff that allow employees to shower and change clothes after cleaning.

### **Housing that supports animals resistance to disease**

Housing should be designed to minimize disease risk factors, such as airway irritation. Access to outdoor air and sunshine is recommended for both dogs and cats, especially in mild climates<sup>5</sup>. This seems to be in direct contrast to the recommendation of one animal facility engineering firm, which does “not recommend openable windows in any animal areas,” and also seems to run counter to a trend away from indoor-outdoor kennels and toward indoor-only kennels. It is rare to see outdoor for access for cats in shelters, even in mild climates; the reason for this is not clear.

Poor drainage and/or poor ventilation may lead to environmental moisture, predisposing animals to disease. Poor air quality from poorly ventilated glass-walled housing may predispose to respiratory disease.

### **Housing that minimize stress and maximizes welfare**

The link between stress and disease is well documented. Stress in shelter housing is often a particularly severe problem for cats. Part of the reason for this is that stress is more difficult to recognize and identify in cats than in dogs. Signs of stress in cats are more subtle (decreased activities such as eating and grooming, feigned sleep, hiding), than those in dogs (repetitive behaviors such as pacing, jumping, circling or vocalizing). High quality housing that reduces stress and improves comfort may cost more and will likely take up more space, meaning fewer units can be built in the same area. However, if the housing keeps animals healthier, encourages friendly behavior, and looks appealing to adopters, animals will likely get adopted more rapidly. The same number of animals can be housed in half the kennels if they move through the shelter twice as fast. Thus, sometimes fewer units of better housing can actually lead to more adoptions as well as better welfare. This is true even when the housing in question is not viewable by the public - keeping a cat or dog comfortable, clean and free of stress during its stay can avert illness and alleviate fearful behavior that could otherwise greatly prolong the animal's time in the shelter.

### **Additional notes on stress reduction**

It is important to reconsider what is accepted as appropriate housing for cats in the design of today's shelters. It is also necessary to consider the length of stay in determining appropriate housing. What may be acceptable for short-term housing of cats (a few weeks) may not be adequate for long-term housing (several months). Even what is routinely considered appropriate for short shelter stays is often inadequate. Welfare of cats in shelters is far too commonly compromised by housing them in unacceptably small barren cages for too long. Shelters should be role models for animal care for the community. We wouldn't adopt cats to people if they told us they were going to keep the cat in a three foot cube! See the next section for recommendations on minimum recommended space per cat.

Provided below are suggested minimal welfare guidelines for cats housed short, medium and long term; the reasoning behind these recommendations is described above. These are merely suggestions: as you are designing a new facility, discuss what you feel should be the minimal provisions for the welfare of animals held for various time periods. Ask yourself what would be acceptable for an adopter, for your own cats, or in another type of holding facility such as a laboratory or pet store. Although we may not be able to provide the ideal environment for all the animals in our care, it is important to consider our absolute minimum standards without necessarily falling back on the accepted way it has “always been done”.

## **Minimum welfare recommendations for cats:**

### **Short term requirements (up to 2-3 weeks):**

- Protection from exposure to infectious disease
- Sufficient room to stretch to full body length (body plus front and back legs stretched to full length)
- Hiding place (separate from litter pan)
- Soft sleeping surface
- Novel and varied toys for cats < 1 year old
- Eat and drink normally (fresh food and water separated from elimination space)
- Freedom from dog view and noise

### **Medium term requirements (3 weeks to 3 months):**

- Opportunity to interact a minimum of ten minutes daily with a familiar human (aside from caretaking/cleaning activities; taking into account individual cat preferences)
- Opportunity to jump, climb and run
- Choice between warm and cool, hard and soft resting surfaces
- Play for all cats – novel and varied toys
- Scratching post

### **Long term requirements (> 3 months)**

- Complete medical and behavioral evaluation every 6 months
- Exposure to varied, non-threatening physical, auditory and visual stimuli
- Paper bags and boxes or things to climb on periodically added and removed, televisions, aquariums, windows, etc.
- Cat social cats: exposure to other cats
- Grass to chew on
- Outdoor access

Humane, low-stress housing is equally important, if not even more important, for new intake and isolation areas than it is for adoption areas. There is often a tendency for adoption area housing to be larger, lighter, more enriched, and less crowded than housing in holding and isolation areas. In the worst cases, sick cats and dogs even have to share the same isolation space. This is likely driven at least in part by a desire to make adoption areas more aesthetically pleasing because these are the areas of the shelter that the public typically sees. This is misguided. In one shelter design brochure, I noticed the statement that “Housing some animals out of public view (other than isolation cases) works against highest adoption and return-to-owner rates.” In certain shelters, dual-purpose holding and adoption housing may be the ideal design (see below). Newly admitted animals who have not adjusted to the shelter environment, and who were just recently vaccinated, have the highest stress levels and may be at the highest risk of disease. Animals that are already sick also need optimal housing to promote recovery. These groups of animals must not be kept in substandard housing.

## **Barking noise**

Decrease barking noise within dog housing areas. Barking noise in shelters is often unacceptably high, and causes physical and psychological stress in dogs.<sup>12</sup> Creating multiple smaller dog housing areas rather than

fewer larger housing areas is probably the most effective way of minimizing barking noise. Other methods, such as using baffles or sound-absorbing materials, are unlikely to significantly impact noise levels and may present other challenges.

Consider group housing for both dogs and cats housed longer-term. Group housing is not recommended for the first few days of the shelter stay, for dogs or cats.<sup>13</sup> Minimize the number of times animals must be re-grouped. Instability in group composition has been shown to cause high stress levels in several species.<sup>14-17</sup> All-in/all-out housing is recommended for minimizing stress<sup>17</sup> and disease in group housing. Again, all-in/all-out housing will be much achieved in a shelter with more numerous, smaller rooms rather than fewer, larger rooms.

### **Avoiding Crowding**

Shelters often feel impelled or compelled to house as many animals as possible in minimal space. They may prefer more numerous, smaller cages over fewer, larger cages, because that allows them to house more animals. Shelters frequently will fill every possible cage with at least one animal, sometimes more, and are usually reluctant to leave cages empty. Small cages intended only for very short-term single housing and double-sided cages intended for a single animal may end up being used inappropriately. Animals that should be segregated from the rest of the population may overflow into other housing areas. In some cases, shelters will even stack extra cages wherever there is room. The resulting high population density may make disease outbreaks inevitable. It is well documented that increased population density has a direct and profound impact on animal health. Studies in various species have shown that crowding is a primary risk factor for stress and disease.<sup>14,18-20</sup> Increased population density also places higher strains on ventilation systems.

### **Shelters should have sufficient capacity to house all animals singly, at least the first several days of the shelter stay.**

Exceptions are litters or bonded pairs that come in to the shelter together. Often, holding areas in open-admission shelters are not designed to hold enough animals singly. The number of holding cages or runs required can be easily estimated using the following formula: annual intake x required holding period / 365 days. This estimate can be increased as needed to account for peaks in intake (e.g. kitten season, large confiscations).

### **Increasing the number of animals that may be housed in adoption areas will not necessarily increase adoptions.**

Instead, this may instead lead to a burgeoning population that staff cannot adequately care for, overcrowding that increases the risk of disease outbreaks, decreased welfare, and decreased customer service.

### **Adequate housing space per animal**

It is often a very hard sell to ask shelters to leave cages empty in order to limit population density and thereby avoid crowding. Population density may therefore be significantly impacted by the space allowance per cage. Space allowance per animal is typically adequate for dogs housed singly, or even in pairs, in double-sided runs with guillotine doors. Typical space allowances for dog runs are 42-48 ft.<sup>2</sup> However, it is extremely common for cats in shelters to be provided with far too little space. One shelter designer's brochure cites a space allowance per cat of 6 ft<sup>2</sup>, only a fraction of the space afforded for dogs. Studies have shown that a space allowance of at least 1m<sup>2</sup> (10.8ft<sup>2</sup>) floor area per cage for singly housed cats is required in order to prevent excessive stress levels.<sup>19</sup> For co-housed cats, an additional 0.75m<sup>2</sup> per additional cat has been suggested by experts.<sup>13</sup> Cages in which cats are unable to stretch their full body length are acceptable only for very short-term housing (maximum 24 hours). Cages for housing cats longer than 24 hours must be large enough to allow separation of at least several feet between feeding, and resting, and elimination areas; a litterbox large enough to accommodate a cat; and sufficient floor space for locomotion and play.

### **Promote agency goals and appropriately serve the target animal population.**

This can be thought of as "Mission driven shelter design," and should be based on characteristics of specific segment(s) of the animal population the shelter plans to serve and house. Before building a shelter, give

Careful thought to what is going to be achieved by the building, and how this fits with the agency's mission. Surely, many shelters have expanded the scope of their services. When expanding shelters, though, the only thought is often only to "house more animals." Other goals such as improving animal welfare, preventing disease, and enabling programs such as shelter transfers, foster care, high-volume spay/neuter, and dog training classes may not be thoroughly considered. Or, shelters may try to "do it all," with one building, when developing a more specialized niche might be more appropriate.

**Example 1:**

A limited-admission, rapid turnover shelter in an affluent community that focuses primarily on shelter transfer of highly adoptable puppies and kittens. This facility could be designed to allow all-in/all-out housing, which is an excellent approach for minimizing disease. This might involve dual function holding & adoption areas, in which groups of dogs from a particular shelter can be held for a quarantine period if needed, viewed by the public, and adopted straight out of the same area rather than having to be held in one area then moved to another for adoption. This will allow shelters that transfer in dogs from several shelters to avoid mixing disease from various source shelters. This shelter would also need multiple isolation areas, as their population might be at high risk for ringworm, parvo, and distemper. Holding areas for strays and/or unadoptable animals are unnecessary in this facility.

**Example 2:**

An animal control facility in a rural community with very limited resources, a low adoption rate, but a high transfer or rescue rate. This facility would need to focus on having adequate capacity for short-term single housing of dogs that may be aggressive and at high risk for disease, and separating newly admitted animals and unlikely adoption candidates from healthy, potentially highly adoptable animals, especially young animals. Isolation areas would be required, but due to this shelter's inability to provide extensive treatment, isolation areas could be relatively low capacity.

**Example 3:**

An adoption-guarantee shelter in an upper-middle class neighborhood, with a high budget per animal and full-time veterinary staff, which accepts primarily adult, owner surrendered animals. This facility may need a full complement of veterinary equipment and hospital facilities to use this equipment. Housing should be appropriate for behavioral rehabilitation, recovery, and longer-term stays, with a focus on cageless, group housing.

Promote veterinary involvement

Computer terminals, space for exams and procedures, office space, consider housing accommodations for veterinary externs.





