

Population Wellness: Keeping Cats Physically and Behaviorally Healthy

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Whereas feline practitioners are usually well versed in the creation of wellness programs tailored to individual cats, optimizing the health of a population of cats requires additional knowledge and poses unique challenges. These challenges will vary depending on many factors, including the nature and purpose of the population itself. Indeed, veterinarians may be tasked with developing health care programs for cat populations in a wide spectrum of settings—from facilities housing laboratory animals, to animal shelters, home-based rescue and foster providers, care-for-life cat sanctuaries, breeding catteries, or large multicat households. Regardless of the setting, a systematic approach to the health of the clowder is crucial for success.

THE COMPONENTS OF WELLNESS

Merriam-Webster's Dictionary defines wellness as "the quality or state of being in good health especially as an actively sought goal."⁸⁰ Ensuring population health requires careful planning and active implementation of

comprehensive wellness protocols that address both animal health and environmental conditions (**Figure 46-1**).⁴¹ Addressing physical health alone is not sufficient to ensure wellness. For example, a cat may be in proper physical condition and free from infectious or other physical disease, yet suffering from severe stress and anxiety. In this case, the patient cannot be assessed as healthy, because its behavioral (emotional) state is compromising its health and well-being. Thus physical health and behavioral health are both essential components of wellness, and preventive health care must actively address each of these.

Addressing the environment of the population is also critically important when considering wellness. Even the best-designed facilities cannot favor good health in a multicat environment without thoughtful implementation of environmental wellness protocols. In small animal practice, environmental wellness is frequently not emphasized simply because many owners are accustomed to providing a reasonably healthy environment for their pets. In contrast, a structured program to address environmental wellness is essential in the

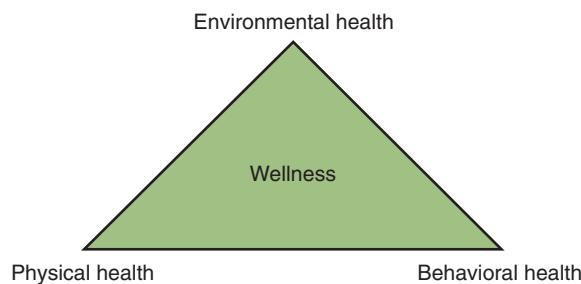


FIGURE 46-1 The inter-relationship among the components of population wellness. To optimize feline health, wellness programs must be carefully structured to address both the physical and behavioral health of the animals, which are intimately linked to their environment, making it crucial to systematically address environmental conditions as well.

context of a population, regardless of the actual physical facility. Proactive measures to maintain clean, sanitary environments that are not overcrowded—where cats are segregated by age and health status and provided with regular daily schedules of care by well-trained dedicated caregivers—are essential.⁴¹

GOALS OF A POPULATION WELLNESS PROGRAM

Simply stated, the overarching goals of a population wellness program are to optimize both the physical and behavioral health of the cats as well as preventing transmission of zoonotic diseases. In other words, a population wellness program should be designed to keep animals “healthy and happy” while keeping human caregivers safe.⁴¹ It is not difficult to identify a healthy population of cats: When wellness protocols are successful, cats “look healthy” and “act like normal cats.” In other words, they appear in good physical condition and display a wide variety of normal feline behaviors, including eating, stretching, grooming, scratching, playing, rubbing, resting, and if allowed, courtship and breeding. Just as changes in a cat’s physical appearance should alert the clinician to potential problems, so should the absence of such normal feline activities and behaviors by members of the group.

Wellness goals must include maintaining the health of individual animals as well as that of the population as a whole. In the context of the population, the individuals that are physically or behaviorally ill serve as indicators or “barometers” of the health care and conditions of the population. When individuals are ill, their health and well-being is always a priority; however, it should also immediately trigger the clinician to ask, “Why is this individual sick? What is the cause of its illness, and how can I prevent this from affecting others?”

More specific goals will vary depending upon the given population and its purpose. For example, in an animal shelter, specific goals of the wellness program might include decreasing the incidence and prevalence of infectious diseases in the shelter and following adoption, decreasing the incidence of problem behaviors in the shelter, decreasing the rate of return of cats to the shelter for problem behaviors, increasing the adoption rate, and so forth. In the context of a breeding colony, the goals might include increasing kitten birth weights, decreasing neonatal mortality, or improving socialization of kittens. By identifying and tracking measurable factors (often called performance targets in large animal medicine), it is possible to measure progress toward these goals. Once baseline data (such as disease rates) are established, it is possible to measure the impact of protocol changes on population health by evaluating these performance targets. Both medical records and a system for regular surveillance and reporting are required to accurately track and access trends in animal health.⁴¹

HEALTH SURVEILLANCE (DAILY ROUNDS)

Early recognition is crucial for effective control of infectious disease and problem behavior in a group. Therefore a regular system of health surveillance must be in place to monitor every individual. In a population setting, daily “walk-through rounds” represent the foundation of an effective animal health care program. Rounds should be conducted at least once daily (preferably twice a day or more often, depending upon the needs of individual cats) for the purpose of monitoring and evaluating both physical and behavioral health. Medically trained caregivers should visually observe every animal and its environment, taking note of food and water consumption, urination, defecation, attitude, behavior, ambulation, and signs of illness, pain or other problems. Monitoring should take place before cleaning so that food intake and the condition of the enclosure, including the presence of feces, urine, or vomit can be noted. Alternatively, observation logs can be completed by caregivers at the time of cleaning and reviewed during walk-through rounds. Any cat that is observed to be experiencing a problem, whether it be signs of respiratory infection, diarrhea, anxiety, or obvious pain, suffering, or distress must be assessed and treated in a timely manner. Regardless of length of stay, regular daily assessment is imperative to identify new problems (medical or behavioral) that may develop so that they can be identified and addressed in a timely fashion to ensure the welfare of the individual animal as well as that of the population.

BOX 46-1**Suggested Topics for Health Care Policies and Protocols^{41,51}**

For each disease or problem in question, the following should be included:

- Definition or description (including cause, transmission [if applicable], and risk to other animals, including humans)
- Description of methods that will be used for diagnosis
- Criteria for notification and contact information for individual(s) to be notified
- General policy describing the handling and disposition of affected cats

- Description of housing/isolation procedures for affected cats
- Description of decontamination procedures, if necessary
- Criteria for treatment, if applicable
 - Who can initiate treatment?
 - Who is responsible for treatment?
 - How will recovery be monitored and defined?
 - How will treatment failure be defined?
- Description of medical record keeping and other documentation of cases

POLICY AND PROTOCOL DEVELOPMENT

In addition to early recognition of health problems, timely action is crucial to effectively limit their morbidity. Ideally, all facilities that house multiple cats should have written policies and protocols in place that detail how medical and behavioral problems will be handled.^{41,51,54} A committee or team of individuals composed of medical staff, managers, and caregivers can establish and oversee these policies and protocols. Such protocols serve as guidelines for systematic triage and care of animals and help to prevent delays in care that may otherwise arise if such plans were not in place. Policies and protocols should be based on medical facts, taking into account the entity's purpose or mission and the availability of resources for care. They should include a definition or description of the disease or condition in question, a description of the methods that will be used for diagnosis, and a general policy regarding the handling and disposition of affected cats. In addition, protocols should include details on notification, housing, decontamination, treatment, and documentation (Box 46-1).

QUALITY OF LIFE AND THE FIVE FREEDOMS

Just as quality-of-life assessment is the responsibility of every veterinarian as they guide the medical care of individual animals, quality-of-life assessment is also a critical part of population health care and monitoring. The factors that affect physical and mental well-being are broad, complex, and often vary substantially among individuals.⁷⁶ Exacting criteria are lacking for the objective measurement of quality of life of cats. However, subjective assessments can and should be made by

BOX 46-2**The Five Freedoms³⁵**

1. Freedom from thirst, hunger, and malnutrition by providing ready access to fresh water and a diet that maintains full health and vigor
2. Freedom from discomfort by providing a suitable environment, including shelter and a comfortable resting area
3. Freedom from pain, injury, and disease by prevention or rapid diagnosis and treatment
4. Freedom to express normal behavior by providing sufficient space, proper facilities, and company of the animals' own kind
5. Freedom from fear and distress by ensuring conditions that avoid mental suffering

medical and behavioral personnel at regular intervals (weekly or even daily, as indicated) considering the most information possible.^{76,109} The "Five Freedoms," which were originally described by the Farm Animal Welfare Council in the 1970s, represent a benchmark for ensuring quality of life or animal welfare³⁵ (Box 46-2). These principles provide a useful framework that is applicable across varying situations and species and have been widely accepted and endorsed by animal care experts.

Many agencies have used the Five Freedoms as the basis of recommendations for minimum standards of care for many species, including cats housed in catteries, shelters, and research facilities.^{7,13,54,87} The tenets of the Five Freedoms define essential outcomes and imply criteria for assessment but do not prescribe the methods by which to achieve those outcomes. Regardless of the setting, population wellness programs should ensure the Five Freedoms for all cats.

MEDICAL DECISION MAKING AND EUTHANASIA

Medical decisions must be weighed in the context of the health of the population as well that of the individual, while considering animal welfare and the availability of resources for care. When large numbers of animals are involved, situations may arise in which animal health and welfare cannot be managed in the case of every individual animal. This may be due to physical or behavioral illness, or environmental conditions that negatively impact animal health, such as crowding. Regardless of the cause, it may be necessary to euthanize affected individuals if no other remedies exist to relieve animal suffering or to protect population health. These decisions can be difficult and emotionally challenging, especially in instances where the individual could easily be treated or otherwise accommodated if adequate resources were available. However, such decisions may be crucial for disease control, animal welfare, and population health.

That being said, euthanasia should never be used as a substitute for providing proper husbandry and care. Indeed, a critical need for a comprehensive wellness program exists in every multicat setting. It is unacceptable to house animals under conditions likely to induce illness and poor welfare, and such conditions can be expected when wellness programs are not in place and carefully monitored.⁴¹

When facilities elect to house cats with medical or behavioral problems, appropriate veterinary care must be provided. It is imperative that a humane plan for diagnosis, treatment/management, monitoring, and housing be implemented in a timely fashion. When determining if cats with special needs can be humanely cared for in a population setting, the following goals and considerations should be addressed: What measures must be implemented to prevent transmission of disease to other cats or people? Can appropriate care realistically be delivered? Will the care provided result in a cure or adequate management of the disease or problem behavior? Can the facility afford the cost and time for care? How will it impact resources available for other cats? In the case of animal shelters, additional considerations should include Will the cat be adoptable? What steps can be taken to minimize the holding time required for treatment? If the cat is not adopted, do humane long-term care options exist in the shelter? What welfare assessment will be used to measure quality of life in the shelter?⁴¹

PROBLEM PREVENTION

Both infectious disease and problem behaviors are common in multicat settings. The old adage, "An ounce of prevention is worth a pound of cure" is certainly true.

Wellness always starts with prevention: It is far more time and cost efficient than treatment, and it is kinder to the animals and their caregivers. With this in mind, population wellness programs should provide broad-based, holistic approaches to preventive care, rather than being based on the control of a single disease or problem, regardless of the setting.

Maintenance of good health or wellness is especially challenging in populations with high turnover and interchange of cats of varying ages and susceptibilities, such as animal shelters. Infectious diseases can become endemic in facilities where populations of animals are housed. Even in closed populations, certain pathogens can be difficult to exclude or to eliminate once introduced. Notably, upper respiratory viruses, dermatophytes, and coccidia are among the most difficult pathogenic agents to control because of their persistence in the environment through carrier states and/or resistance to environmental disinfection.

In particular, upper respiratory disease is the most common endemic disease in cat populations and is impossible to completely prevent in an open population. Feline herpes virus type 1 (FHV-1) and feline calicivirus (FCV) have been implicated as the causes of most infections: Both viruses induce persistent carrier states and are widespread in the cat population.³⁶ Cats that recover from FHV-1 remain latently infected and shed virus intermittently, especially following periods of stress. FCV carriers shed continuously for months to years following infection. A variety of other viral and bacterial pathogens may also contribute to feline upper respiratory disease, and *Bordetella*, *Chlamydophila*, and *Mycoplasma* are problematic in some populations. Feline infectious peritonitis (FIP) is another disease that is nearly impossible to eradicate from a multicat environment, and sporadic cases can be expected to occur, especially in young cats.⁹³ Fortunately, proper wellness programs can greatly limit the incidence and severity of diseases, even for pathogens that are difficult to control.

THE ROLE OF STRESS

The multicat environment also presents enormous opportunities for inducing stress. Because of their unique biology, cats are particularly prone to experiencing acute stress and fear in novel environments. Anything unfamiliar to a cat can trigger apprehension, activating the stress response. Confinement in a novel environment can result in a wide variety of behavioral indicators of stress including hypervigilance, feigned sleep, constant hiding, activity depression, and loss of appetite, among others. In the long term, if cats are unable to acclimate or cope in their environments, chronic stress, fear, frustration, or learned helplessness may result. In group settings, signs of social stress may also manifest with

increases in problem behaviors, including urine marking, spraying, or other inappropriate elimination; constant hiding; and/or aggression.⁴⁶ Stress not only has the potential to negatively impact behavioral health but also physical health as well. The intimate link between stress and immunity has been well described. In fact, stress is a leading factor in the development of infectious disease and is particularly important in the pathogenesis of feline upper respiratory infections.^{37,47} Wellness programs that reduce stress will also serve to minimize the morbidity of infectious disease.

CONSIDERATIONS REGARDING INFECTIOUS DISEASE TRANSMISSION

Despite the fact that infectious agents can never be completely eliminated from the environment, it is still possible to maintain good health. This is because the development of disease is determined by a complex interaction of many factors surrounding the host, the infectious agent, and the environment. Keeping these factors in mind provides a rational context for many of the recommendations in this chapter.

Some of the host factors that influence health and the development of disease include age, sex and reproductive status, immune status, body condition, stress, and genetics.³⁹ The amount and duration of exposure to an infectious agent (i.e., the “dose effect”), as well as its virulence and route of inoculation, also influence the likelihood and severity of disease. In addition, environmental conditions contribute to the development of infectious disease, including such factors as housing density, sanitation, and fluctuations in temperature or air quality. The fact that disease results from such a large combination of factors underscores the importance of a holistic and broad-based approach to population wellness.

GENERAL PRINCIPLES OF INFECTIOUS DISEASE CONTROL

When infectious disease does occur in a population, general principles of infectious disease control should guide the response. These include

- Removal of infected animals from the population
- Mass vaccination
- Mass treatment
- Quarantine of new arrivals or closure to admission
- Review of husbandry procedures (animals and environment)
- Staff education and communication

Coupled with vigilant surveillance to ensure early recognition of disease, these serve as the foundation of all

disease control efforts when disease is present. However, the best method of disease control is always prevention.

ESSENTIAL ELEMENTS OF A POPULATION WELLNESS PROGRAM

When creating preventive medicine programs for a population, consideration must be given to all components of wellness: physical, behavioral, and environmental health.⁴¹ With regard to promoting physical health, wellness programs should address the following essential elements:

- Patient history and physical examination
- Disease testing
- Vaccination
- Parasite control/prevention
- Spay/neuter
- Proper nutrition
- Grooming
- Periodontal disease prevention
- Breed-specific care

Likewise, to promote behavioral wellness, programs should include provisions for the following essential elements:

- History and behavioral care at intake
- Proper housing
- Social companionship
- Mental and physical activity
- Consistent daily routines

Finally, wellness protocols aimed at creating an environment that promotes health must take into account the following essential elements:

- Population density
- Cleaning and disinfection
- Segregation and traffic patterns
- Facility operations (e.g., heating–ventilation–air-conditioning [HVAC], noise and pest control, staff training)

MEDICAL RECORD KEEPING AND CAT IDENTIFICATION

Implementing population wellness protocols and ensuring quality and timely care require reliable systems for medical record keeping and animal identification. Regardless of the system used, medical record keeping procedures should comply with state and local practice acts, guidelines provided by state and national veterinary medical associations, and, in the case of laboratory animals, regulations as prescribed by federal law, the



FIGURE 46-2 A plastic neckband designed for animals is used as an identification collar for this shelter cat (Safeguard 821, Precision Dynamics Corp., San Fernando, Calif.).



FIGURE 46-3 Cats in a private cattery wear collars with identification tags. Visual identification is essential for cats, regardless of the setting, and most cats can safely and reliably wear collars.

Institute for Laboratory Animal Research and Institutional Animal Care and Use Committees. Computerized records are preferred; however, written records may also be used. Computerized records offer the advantage of mechanized reporting, which facilitates detection and monitoring of health trends in the population. A medical record should be prepared for each cat and should include the cat's entry date, identification (ID) number, date of birth, gender, breed, and physical description, as well as historical and physical/behavioral examination findings. In addition, it should contain the dosages of all drugs administered and their routes of administration, including vaccines, parasite control products, other treatments, and anesthetic agents; the results of any diagnostic tests performed; any surgical procedure(s) performed; and other pertinent information regarding the animal's condition. Standardized examination and operative reports may be used, but should allow for additions when necessary.

Identification of cats in the form of a neckband, collar and tag, tattoo, earband, and/or a microchip is also essential for preventive health care and ongoing surveillance of individuals.⁴⁵ Whenever possible, some form of identification should be physically affixed to every individual cat. In addition, enclosures should be labeled with the cats' unique identification number and/or name.

Identification Collars

Contrary to popular belief, most cats can reliably wear collars safely and comfortably.⁶⁵ Many facilities use disposable collars, including commercially available plastic or paper neckbands made for animals or hospital-type wristbands made for human patients (Figure 46-2). Commercially available cat collars with an ID tag affixed

are also a good option (Figure 46-3). Some facilities prefer to use safety collars that are designed to break away should the collar become caught on something. Even for kittens, collars can be used and may be especially beneficial, because they will learn to wear them from an early age.

Microchips

Microchips may also be used for identification and are safe and simple to implant (Figure 46-4). The procedure is well tolerated by the vast majority of cats without the need for sedation. Unlike visual means of identification, a scanner is necessary for positive identification of a microchipped animal. For this reason, microchips are often used in conjunction with a visual means of identification and serve as important permanent means of backup identification. **Box 46-3** describes the proper technique for scanning for a microchip.

During the last 2 decades, microchips of varying radiofrequencies (125, 128, and 134 kHz) have been introduced in the United States.⁴ The 125-kHz chips have historically been the most common, whereas the accepted standard in the rest of the world is the 134-kHz chip. Because some scanners read only certain radiofrequencies, it is possible to miss detecting a microchip that is present, depending on the scanner being used. Currently, there are efforts to standardize microchipping in the United States, including widespread distribution of universal (global) scanners to ensure that all implanted microchips can be reliably identified. Once global scanners are widely available, the American Veterinary Medical Association (AVMA) recommends adoption of the 134-kHz (ISO) microchip as the American standard, because this frequency is recognized as the international standard for microchips.



FIGURE 46-4 Microchip identification. Small (12- × 2-mm) microchips can be easily implanted in most cats, without sedation, using a needle. Cats may be scanned for reliable permanent identification. (From Griffin B, Hume KR: Recognition and management of stress in housed cats. In August JR, editor: Consultations in feline internal medicine, vol 6, St Louis, 2006, Elsevier, p 717.)

in the rest of the world. Efforts have also focused on improving, updating, and centralizing microchip registries. This is extremely important in the context of animal shelters. **Box 46-4** contains information on the use of collars and microchips as tools for improving cat-owner reunification.

Tattoos

In laboratory settings, tattoos may be used as a means of permanent identification of cats (Figure 46-5).⁴⁵ Tattoos are most commonly applied to the inner pinna of the ear using a tattoo machine with multiple needles. Care must be taken to properly disinfect the needles between patients. A significant disadvantage of tattooing is that tattoos can sometimes be difficult to read because of the presence of hair, fading, or distortion that may occur as the cat grows. In addition, their application requires anesthesia or heavy sedation.

Earbands

Small stainless steel ear tags manufactured for wing banding of birds are especially useful for identifying

newborn kittens in some settings and are highly economical (Figure 46-6).⁴⁵ They can be placed without the need for anesthesia or sedation when kittens are less than 10 to 14 days old. Placing earbands requires skill and experience. They must be positioned in such a way as to provide adequate space for growth of the ear, while seating them deeply enough in the ear margin to ensure a secure piercing far enough away from the edge. If placed too close to the ear margin, the ear flap may tear, resulting in loss of the band. Other complications include local inflammation or infection at the site of the piercing. Ear tags are a practical method for identifying individual kittens in institutional or commercial breeding colonies, because when applied skillfully, they are seldom lost and provide reliable, long-lasting visual identification.

In contrast, private breeding catteries and animal shelters generally prefer to use methods that will not alter the cat's cosmetic appearance long term. Colored ribbon, nail polish, or clipping of hair in various areas of the body can all be useful means of temporary kitten identification in the neonatal stage, especially when coat color or patterns do not easily allow individuals to be distinguished.

BOX 46-3**Microchip Scanning Technique**

Every cat, including those surrendered by their owners, should be systematically scanned for the presence of a microchip at the time of intake, as well as prior to being made available for adoption or being euthanized. Proper technique and scanning more than once are crucial to avoid missing microchips.^{67,68} A universal (global) scanner (e.g., one that will read all microchip frequencies that are currently in use) should be used to ensure that all microchip frequencies are detected. At this time, the only universal scanners available in the United States are the new Home Again Global World scanner (Schering Plough, Whitehouse Station, NY) and the iMax Black Label ResQ scanner (Bayer Animal Health, Shawnee Mission, Kans.). One of the most common causes of scanner failure is weak batteries; therefore it is imperative that batteries be checked and replaced regularly.

To ensure a thorough scan and avoid missing chips, cats must be removed from carriers or cages prior to scanning. Metal and fluorescent lighting may interfere with chip detection. Metal exam surfaces should be covered with a towel or other material prior to scanning to minimize interference. The entire animal should be scanned using a consistent speed, scanner orientation, scanning pattern, and distance.

- Scanner orientation: The scanner should be held parallel to the animal. Rocking the scanner slightly from side to side will maximize the potential for optimal chip orientation and successful detection. The button on the

scanner should be depressed continuously during the entire scanning procedure.

- Scanning distance: The scanner should be held in contact with the animal during scanning such that it is lightly touching the hair coat.
- Scanner speed: The scanner should not be advanced any faster than 0.15 m/second (0.5 ft/second). Scanning slowly is crucial, because universal scanners must cycle through various modes to read all possible chip frequencies.
- Areas of animal to scan: The standard implant site is midway between the shoulder blades, and scanning should begin over this area. If a microchip is not detected here, scanning should proceed systematically down the back, on the sides, neck, and shoulders—all the way to the elbows in the front and the hindquarters in the rear.
- Scanning pattern: The scanner should be moved over the scanning areas in an "S"-shaped pattern in a transverse direction (from side to side). If no microchip is detected, the scanner should be rotated 90 degrees, and then the "S"-shaped pattern should be repeated in a longitudinal direction (e.g., the long way) on both sides of the animal. This pattern of scanning will maximize the ability of the scanner to detect the microchip, regardless of its orientation.

BOX 46-4**Use of Identification (ID) Collars and Microchips to Improve Cat–Owner Reunification**

- Less than 2% of cats are reunited with their owners, compared to as many as 15% to 19% of lost dogs.⁸⁶
- The use of collars and tags as visually obvious forms of identification is extremely valuable, although overlooked by many cat owners.⁶⁹
- Cats wearing collars are more likely to be identified as owned and not mistaken for strays.
- Even indoor cats require identification in case they escape, and studies clearly demonstrate that visual identification improves the odds of pet-owner reunification.⁶⁹
- The provision of permanent identification in the form of a microchip represents an important backup, further improving the odds of pet-owner reunification because collars and tags can be lost.⁶⁶
- Because owners and shelter staff often describe cat coat color and patterns differently, photographs that can be

posted online are a useful method of improving lost-pet matching and enabling owners to look for their pet, even if they are physically unable to come to the shelter.

- Adopted animals should be sent home with ID collars and microchips.
- Shelter staff should always register microchips before the cat leaves the shelter, because many owners will neglect to do so following adoption, making the microchip an ineffective means of identification.⁶⁶
- Web-based search engines for pet microchip identification numbers (<http://www.checkthechip.com> and <http://www.petmicrochiplookup.org>) have been established in an effort to functionally centralize microchip registries by linking existing national databases.



A



B

FIGURE 46-5 Permanent tattoo on the inner pinna of the ear of a laboratory cat. This form of identification requires heavy sedation with appropriate analgesia for placement. (From Griffin B, Hume KR: *Recognition and management of stress in housed cats*. In August JR, editor: *Consultations in feline internal medicine*, vol 6, St Louis, 2006, Elsevier, p 717.)



A



B

FIGURE 46-6 Earband identification. Small stainless steel bands manufactured for wing banding of birds are ideal for identification of young kittens in a laboratory setting. (From Griffin B, Hume KR: *Recognition and management of stress in housed cats*. In August JR, editor: *Consultations in feline internal medicine*, vol 6, St Louis, 2006, Elsevier, p 717.)

MANAGEMENT OVERSIGHT

The success or failure of a population wellness program hinges in large part on its implementation and oversight. A knowledgeable, cohesive, and dedicated team, where accountability, responsibility, and lines of authority are well defined, is crucial for management success.

As a part of the management structure and plan, veterinarians must be involved in the oversight of all aspects of animal care and must be given direct authority for the oversight of medical decisions. This requires that every

facility that houses cats establish a formal relationship with one or more veterinarians who have direct knowledge of their animal population. This is essential to ensure that medical protocols are established with the proper professional oversight, and helps to ensure compliance with local veterinary practice acts that restrict the practice of veterinary medicine to licensed veterinarians. In facilities such as animal shelters, trained shelter staff can carry out preventive health care under the instructions of a veterinarian.⁶

DEVELOPING A POPULATION WELLNESS PROGRAM: CONSIDERATIONS FOR PHYSICAL HEALTH

The clinician should develop a program for physical health for the population that addresses all of the essential elements as noted. None of these should be considered as optional, but their implementation will depend on the setting, purposes, and resources of the group.

History

The value of obtaining an accurate medical history on any cat entering a population is immeasurable, because it will often alert the clinician to the presence of potential problems. In a laboratory setting, obtaining cats from commercial purpose-bred colonies or institutional breeding colonies ensures that an accurate history will be available, maximizing the odds that only healthy cats will be added to the population. Likewise, private breeding catteries should always strive to obtain an accurate medical history on any cat that may be accepted into the cattery. The introduction of cats from random sources to closed populations of cats risks the health of the population and should be avoided whenever possible.⁴⁵

In contrast, by their very nature, animal shelters must frequently receive cats from multiple random sources, and it will not always be possible to obtain accurate histories. In some cases, cats are brought in by animal control officers or good Samaritans who have little if any information about them. Furthermore, some shelters provide a location (e.g., drop-off cages) where cats can be relinquished after business hours. This practice should be discouraged; however, if facilities elect to do this, every effort must be made to obtain a history through questionnaires that can be completed when the cat is left. The presence of staff to directly accept cats and obtain a history at the time of relinquishment is greatly preferred.⁴¹ Even so, surrendering owners may or may not provide complete or accurate information, fearing that if they are honest about a pet's problems, the pet may be euthanized. Nonetheless, when available, a history can be extremely valuable, saving time and money as well as preventing unnecessary stress for cats and staff alike. Intake procedures should be in place to capture basic patient information, including both physical and behavioral data as well as the reason(s) for relinquishment. The importance of obtaining historical information cannot be overemphasized. In many cases, historical information may be used to expedite the disposition of the cat in the shelter.

Physical Examination

Physical examination is the clinician's single most important tool for evaluating health. Following a standardized physical examination form will ensure a complete and systematic review of all body systems. A veterinarian should carefully examine any new cat entering a closed population prior to admittance. In the context of animal shelters, every cat that is safe to handle should receive a physical examination at or as close to the time of admission to the shelter as possible. In many shelters, a veterinarian may not be available to examine incoming animals. However, staff can and should be trained to perform basic evaluations including sexing, aging, body condition scoring, and looking for evidence of fleas, ear mites, dental disease, overgrown claws, advanced pregnancy, or other obvious physical conditions. Of particular importance in the shelter physical examination are an accurate physical description of the animal and careful inspection for the presence of identification, both of which may aid in pet-owner reunification.⁴¹

Disease Testing

The gold standard for maintaining the health of a population is through exclusion of pathogens in combination with implementation of comprehensive wellness protocols. This requires that members of a population be free from specific pathogens when the group is established and that the colony be closed to any new individuals that do not meet the health standards of the group.⁴⁵ This is the foundation of disease control procedures in a laboratory animal setting, and these concepts should be applied to other population settings whenever possible. Consideration should be given to testing for the following: feline leukemia virus (FeLV), feline immunodeficiency virus (FIV), dermatophytosis, intestinal parasites and infections (e.g., *Campylobacter*, *Giardia*, coccidia), as well as other endoparasites and ectoparasites. The setting and resources available, as well as the individual's history and physical examination findings, should guide the clinician's decisions regarding selection of testing for cats entering a specific population. When new stock is added to a closed colony, disease testing is imperative.

Feline Leukemia Virus and Feline Immunodeficiency Virus

The American Association of Feline Practitioners (AAFP) maintains detailed professional guidelines for the management of FeLV and FIV infections. Identification and exclusion of infected cats is the most effective method of preventing new infections. Cats and kittens should always be tested prior to entry to a closed population. Those that test negative should be retested, because it

may take as long as 60 days following exposure for a cat to test positive.^{62,63}

In the context of animal shelters, testing decisions are often influenced by the availability of resources. The AAFP's guidelines include recommendations specifically for shelters. They state that all cats should ideally be tested at the time of entry and again in 60 days in case of recent exposure. When cats test positive on screening tests (e.g., point-of-care enzyme-linked immunosorbent assay [ELISA] tests), the AAFP recommends that the results be confirmed by additional testing, including testing over an interval of time, because false positives can occur. However, such confirmatory testing requires substantial time and monetary investment and may not be feasible in many shelters. In recognition of this, the Association of Shelter Veterinarians established a policy statement on "Management of Cats Who Test Positive for FeLV and FIV in an Animal Shelter," which states that the logistics and cost of holding and retesting unowned cats may be an ineffective use of resources.⁵ In addition, it can be difficult to find homes for retrovirus-positive cats, which in many instances translates into stressful, prolonged shelter stays. Such long-term confinement may compromise quality of life and may compound the emotional stress of caregivers who may later be faced with euthanizing cats that have been held for long periods awaiting confirmatory testing or adoption opportunities. For all of these reasons, many shelters elect to euthanize cats that test positive on retrovirus screening tests.

Although it may be ideal for shelters to test cats on entry, it is not always feasible because of financial constraints. The next best practice might be to test cats prior to adoption as well as those that are housed in the shelter long term. In addition, cats should be tested prior to placement in group housing with unfamiliar cats and prior to investment, such as foster care, treatment, or spay/neuter surgery. However, given the limited resources of many shelters, the relatively low prevalence in healthy cats and the fact that transmission can be prevented by housing cats separately, it may not be cost effective for all shelters to screen every cat before selection for adoption. Each shelter should evaluate its own resources and determine their best use. When testing is performed, samples must never be pooled, and the negative results of one cat (such as a mother cat) should not be extrapolated to other cats (such as her kittens). These practices are invalid and can falsely lead to misidentification of a cat's true infection status.^{62,63} If testing is not performed prior to adoption, adopters should be advised to have their new pet tested and to keep them separate from any other cats they may own prior to doing so.

Feline Heartworm Disease

Point-of-care heartworm tests for cats have recently become more widely available, but interpreting results

can be problematic.² In relation to population health, testing is of little value, because infected cats pose no risk to other cats. Nonetheless, a clinician may elect testing as part of an initial database for individual cats, especially if they will be used for breeding. With heartworm tests readily available in combination with point-of-care FeLV/FIV tests, many animal shelters have been faced with determining whether or not to perform routine screening of cats in their care. To answer this question, it is helpful to consider the following:

- Infected cats pose no risk to other cats and usually remain asymptomatic.
- Even if infection is diagnosed in asymptomatic patients, definitive treatment is neither practical nor safe.
- Most infections resolve spontaneously with time and are not associated with a shortened life span.³⁸
- Counseling owners about positive test results poses unique challenges.
- Positive test results may alter a cat's disposition in the shelter.

In consideration of these facts, the author does not recommend routine screening of cats for heartworm disease in shelters. Monthly chemoprophylaxis, however, is a safe and effective option for cats sheltered in areas where heartworm infection is considered endemic.

Dermatophytosis

Dermatophytosis or ringworm, the most common skin infection of cats, is a known zoonosis. It is caused by infection of the skin, hair, and nails with microscopic fungal organisms that cause varying degrees of hair loss and dermatitis. The dermatophyte that causes the majority of cases in felines is *Microsporum canis*, which is responsible for greater than 96% of all cases.⁸² If left untreated, most infections will spontaneously resolve within 12 to 14 weeks postinfection. However, during this time, the infected cat will infect the surrounding environment and other animals or humans in the area. Not all cats infected with dermatophytosis develop lesions, and some may become chronic carriers. Control of dermatophytosis is difficult, because the spores formed by *M. canis* can survive in the environment for up to 18 months or longer and are extremely resistant to disinfectants and detergents. In addition, the presence of asymptomatic carriers makes it difficult to readily recognize all infected cats. For this reason, consideration should be given to culturing all cats prior to entry to a closed colony. In particular, Persian cats may be predisposed to dermatophyte infection and can be particularly difficult to clear once infected. In closed colony settings, dermatophyte testing by culture is highly recommended unless the source of the cat excludes the possibility of infection (e.g., specific pathogen-free [SPF] cats, purpose-bred laboratory cats). To screen cats using cultures,

samples should be collected using the McKenzie tooth-brush method, where a new toothbrush is used to brush the cat's entire body, giving special attention to the face, ears, and limbs. In addition, if skin lesions are present, hair should be plucked around these areas for culture as well.

Enteric Pathogens

Campylobacter, *Salmonella*, *Giardia*, coccidia, *Tritrichomonas*, and other gastrointestinal parasites and pathogens are common in some cattery situations and can be very difficult to eliminate once they are introduced. In fact, in some settings, these pathogens may become endemic and nearly impossible to eliminate. Treatment of coccidia in shelter kittens is described in Box 46-5. Although clinical signs, such as diarrhea, may be associated with infection, some cats remain asymptomatic. These pathogens have the potential for high morbidity in a population (especially in young kittens), and some possess zoonotic potential. Therefore routine fecal examinations, cultures, and/or empirical treatments should be considered prior to the introduction of new cats.

Vaccination

It is well recognized that vaccination plays a vital role in the prevention and control of infectious diseases. Protocols should be established in the context of the population's exposure risk, which will vary depending upon the setting. In the context of population medicine,

vaccination protocols are typically applied uniformly to all of the individuals comprising the population. This simplifies their application and helps to afford the best possible protection for the group. Detailed vaccination records should be maintained for each cat, including vaccine name, manufacturer and serial number, date, the initials of the person who administered it, and any adverse reactions.⁹⁶

Proper vaccination can substantially reduce disease in cat populations, and serious adverse reactions are relatively rare. For this reason, vaccination against certain core diseases is recommended in all population settings. Although exclusion of infectious disease is always a goal of health management, certain pathogens are so widespread that even with careful biosecurity in a closed population, an infection may be introduced to susceptible cats. Only in the case of specific pathogen-free colonies, where there may be a compelling reason not to vaccinate as dictated by the purposes of the research, should vaccination be foregone. The AAFP maintains published guidelines for vaccination of cats in a variety of settings and includes detailed recommendations for cats in animal shelters.⁹⁶

Core Vaccines for the Population: Feline Viral Rhinotracheitis, Calicivirus, Panleukopenia (FVRCP)

Although many vaccines are commercially available for cats, only a few are recommended for routine use in populations. Unnecessary use of vaccines should be avoided to minimize the incidence of adverse reactions and reduce cost. Core vaccines involve diseases that represent significant morbidity and mortality and for which vaccination has been demonstrated to provide relatively good protection against disease. Core vaccines for cats in a population setting include feline parvovirus (FPV or panleukopenia), FHV-1 (feline herpes virus type 1 or feline rhinotracheitis virus), and feline calicivirus (FCV).⁹⁶ These vaccines are usually given in a combination product commonly referred to as an FVRCP vaccine (feline viral rhinotracheitis, calicivirus, panleukopenia).

In most cases, timely vaccination against panleukopenia will prevent the development of clinical disease. In contrast, vaccination against the respiratory viruses (FHV-1 and FCV) does not always prevent disease. In many instances, it affords only partial protection, lessening the severity of clinical signs but not preventing infection. To optimize response, modified live vaccines (MLV) should be used in most cases, because they evoke a more rapid and robust immune response and are better at overcoming maternal antibody interference than killed products. This is especially important in multicat environments in which the risk of infection is high, such as animal shelters, foster homes, as well as any population setting where upper respiratory disease is endemic. A

BOX 46-5

Ponazuril for Control of Coccidia in Multicat Environments

Ponazuril is a metabolite of toltrazuril that has proven activity against coccidia.* Because there is no approved product for use in cats, the equine product Marquis Oral Paste (15% w/w ponazuril; Bayer HealthCare) may be dosed at 50 mg/kg, PO, once daily for 1 to 5 days. Prophylactic treatment may be instituted in high-risk situations, such as young kittens in environments with documented infection. Proper hygiene, including the use of disposable litter boxes and frequent removal of feces, is also necessary. Oocysts survive in the environment and are not treated by routine disinfectants, such as bleach and quaternary ammonium compounds.

Preparation of the equine product for use in cats:

10 mL Marquis Oral Paste added to 20 mL water =
30 mL of 50 mg/mL oral suspension

*Data from Lloyd S, Smith J: Activity of toltrazuril and diclazuril against *Isospora* species in kittens and puppies, *Vet Rec* 148:509, 2001.

single modified live FVRCP vaccine will usually afford protection to cats that are at least 4 months of age. In contrast, killed products require a booster in 2 to 3 weeks to confer immunity, making their use largely ineffective in such environments.⁹⁶

To ensure rapid protection against panleukopenia, injectable FVRCP vaccines are preferred, but intranasal vaccines may offer advantages for feline respiratory disease, because they have been shown to rapidly induce local immunity at the site of exposure. Furthermore, intranasal vaccines may be better at overriding maternal antibody in young kittens. For this reason, they are often used to reduce the morbidity and severity of upper respiratory infection (URI) in preweaning-age kittens. When intranasal vaccines are used in animal shelters, they should be used in combination with injectable FVRCP vaccines to ensure and optimize response against panleukopenia as well as the respiratory infections.⁹⁶

Ideally, all cats should receive a MLV FVRCP vaccine at least 1 week prior to entering a population. In the context of an animal shelter setting, this is seldom feasible. Vaccination immediately upon entry is the next best practice and can provide clinically significant protection for the majority of cats. If neither maternal antibody nor another cause of vaccine failure interferes, modified live vaccinations against panleukopenia will often confer protection against disease in only 5 days.¹² Intranasal vaccines against respiratory infections, including FHV and FCV, typically provide partial protection within 2 to 4 days.^{18,30}

In animal shelters, all incoming cats and kittens 4 weeks of age and older that can be safely handled should receive an injectable MLV FVRCP vaccine immediately upon entry. A delay of even a day or two significantly compromises the vaccine's ability to provide timely protection. Even injured cats, those with medical conditions, and those that are pregnant or lactating should be vaccinated on entry, because vaccination will likely be effective and the small risk of adverse effects is outweighed by the high risk of disease exposure and infection in the shelter.⁹⁶ When vaccination of all cats on entry is not financially feasible, the next best practice is to vaccinate all those that are deemed adoptable at the time of entry or that are likely to be in the shelter long term.⁴¹ Whenever possible, vaccinated cats should be separated from those that will remain unvaccinated (e.g., those that will be euthanized following a brief holding period) as soon as that determination can be made.

In contrast, in lower-risk settings, ensuring that cats are in good health prior to vaccination should be a priority.⁹⁶ Vaccination of kittens with injectable FVRCP vaccinations may be delayed to 6 to 8 weeks of age. However, when respiratory disease is endemic, administration of intranasal vaccines beginning at 4 weeks of age may be beneficial. In breeding catteries, queens (especially those

with a history of upper respiratory infection) may benefit from vaccination prior to breeding to maximize passage of maternal antibody to their kittens. For pregnant cats in such environments, administration of MLV should be avoided, because the potential risk of injury to the developing kittens may outweigh the risk of infection in this case. Vaccination of lactating queens should also be avoided in a low-risk environment.

A series of vaccinations should be administered to kittens less than 4 months of age to minimize the window of susceptibility to infection and ensure that a vaccine is received as soon as possible after maternal antibodies have decreased sufficiently to allow vaccine response.⁹⁶ For kittens, vaccines should be administered every 2 to 4 weeks until they are 16 weeks (e.g., 4 months) of age or their permanent incisors have erupted. The minimum interval of 2 weeks is recommended in high-risk settings to narrow the window of susceptibility as maternal antibody wanes. A vaccination interval of less than 2 weeks is not recommended, because it may actually blunt the immune response from previous vaccination.⁴⁰ In the case of an outbreak of panleukopenia, extending vaccination to 5 months of age may be warranted to ensure than no animal remains susceptible. Although the vast majority will respond by 4 months of age, a few may fail to respond, while others are provided with a boost to enhance the immune response.

Just as in owned pets, booster vaccines are generally not required until 1 year later for modified live vaccines but should ideally be administered once in 2 to 4 weeks whenever resources permit. This may be especially important for cats that were ill at the time of initial vaccination, as may be the case in an animal shelter. Revaccination in long-term shelter facilities should follow the guidelines set forth for pets: Boost at one year, then every 3 years for FVRCP.⁹⁶

Rabies Vaccination

Vaccination against rabies virus is regarded as a core requirement for pet cats and is required by law in some jurisdictions.⁹⁶ Thus vaccination against rabies is recommended in the context of private catteries. In contrast, rabies vaccination may be considered optional in most closed laboratory settings, because the risk of exposure should be absent and legal requirements may not apply. In animal shelters, vaccination against rabies is not generally recommended at the time of admission, simply because there is no benefit in terms of disease prevention or public health.⁹⁶ Vaccination on admission will not provide protection against an infection acquired prior to entry, nor will it limit concern if a cat with an unknown health history bites someone soon after admission. Rabies vaccination is recommended for cats prior to adoption when a veterinarian is available to administer it (or as otherwise legally prescribed by state laws). Alternatively, rabies vaccination may be administered as

soon as possible following adoption.⁴¹ The latter may encourage new owners to establish a relationship with a private veterinarian. Rabies vaccination is warranted when cats are housed long term in shelter facilities. In addition, if individual cats must be held for bite quarantines, they should be vaccinated against rabies in accordance with the current Compendium of Animal Rabies Prevention and Control.⁸⁵

Noncore Vaccines

Noncore vaccines include those that may offer protection against disease, but because the disease in question is not widespread or only poses a risk of exposure in certain circumstances, vaccination is only recommended based on the individual risk assessment of a population of animals. Noncore vaccines include FeLV, FIV, *Chlamydophila*, and *Bordetella*.⁹⁶

FELINE LEUKEMIA VIRUS

Vaccination against FeLV is not warranted in a closed population of cats in which there is no risk of exposure (e.g., most laboratory animal settings). In private catteries, a risk assessment should be done to determine if vaccination is warranted (e.g., cats permitted in outdoor enclosures, frequent introduction of cats from external sources, other opportunities for exposure). Special consideration should be given to vaccinating kittens because of their high susceptibility to FeLV infection and the high likelihood that they will become persistently infected if exposed. In general, FeLV vaccination is not recommended in animal shelters when cats are housed short term. However, its use is warranted when cats are group housed when resources permit.⁹⁶

FELINE IMMUNODEFICIENCY VIRUS

FIV vaccination is not generally recommended in population environments. A confounding feature of FIV vaccination is that vaccinated cats develop false-positive test results on most commercially available tests (see Chapter 33). If FIV vaccination is elected, vaccinated cats should be permanently identified (e.g., by use of a microchip) to help clarify their status.⁹⁶

CHLAMYDOPHILA AND BORDETELLA

Chlamydophila felis (*C. psittaci*) and *Bordetella bronchiseptica* vaccines may be of benefit when clinical signs of these diseases are present in the population and diagnosis is confirmed by laboratory evaluation. Their efficacy is moderate, and reactions are more common than with most other feline vaccines; therefore ongoing use should be periodically reassessed.⁹⁶

Vaccines Not Recommended

Some vaccines are not generally recommended for use because of undemonstrated efficacy, such as the feline infectious peritonitis (FIP) vaccine.⁹⁶

Parasite Control and Prevention

Control and prevention of internal and external parasites represent another important component of a population wellness program. Common products used for their management are described elsewhere in this book. Of particular importance are roundworms and hookworms, common intestinal parasites with zoonotic potential (see Chapter 23). Although uncommon, the risk of human infection from contaminated environments is real and can result in organ damage, blindness, and skin infections. For this reason, the Centers for Disease Control and Prevention and the Companion Animal Parasite Council strongly advise routine administration of broad-spectrum anthelmintics for their control.^{17,20} Pyrantel pamoate is one of the most cost-effective and efficacious drugs for treatment and control of roundworms and hookworms. In both shelter and cattery settings, the author recommends administration of pyrantel pamoate at a dosage of 10 mg/kg to all cats with re-treatment in 2 weeks and then at monthly intervals.⁴¹ In shelters, if it is not possible to treat all cats at the time of entry, at a minimum, all cats that are deemed adoptable should be treated as soon as possible. In addition, kittens should be treated at 2-week intervals until 4 months of age. For cats with diarrhea, fecal examination (e.g., flotation or centrifugation, direct fecal smear and cytology) should be performed with treatment according to results. Even if results are negative, the administration of broad-spectrum anthelmintics should be strongly considered.

In animal shelters, ectoparasites, particularly ear mites and fleas, are also very common in cats and kittens. Shelter staff should be trained to recognize infestation and protocols should be established for treatment. In terms of shelter treatment protocols, the author recommends treating ear mites with ivermectin, because it is highly efficacious and costs only pennies per dose. The recommended dosage is 0.3 mg/kg subcutaneously. For fleas, the author recommends topical treatment with fipronil (Frontline, Merial, Duluth, Ga.) as a spray or top spot. In particular, the spray is very cost effective. It is safe for use in cats of all ages, including pregnant and nursing mothers and neonatal kittens. In addition, fipronil also has activity against ear mites, *Cheyletiella*, chewing lice, and ticks.^{19,100}

Spaying and Neutering

Spaying and neutering is another important consideration in the context of population wellness.⁴¹ Reproductive stress from estrous cycling in queens and sex drive in tomcats can decrease appetite, increase urine spraying/marketing and intermale fighting, and profoundly increase social and emotional stress in the group. For these reasons, spaying and neutering cats that will not be used

for breeding is recommended. In animal shelters, spaying and neutering cats prior to adoption will ensure that they do not reproduce and contribute to the surplus of community cats. This will also serve to enhance husbandry, because the procedures rapidly decrease spraying, marking, and fighting; eliminate heat behavior and pregnancy; and greatly mitigate stress. In addition to reducing stress and odor, spaying and neutering sexually mature cats will facilitate group housing, which is often beneficial for cats, especially when housed longer term (see below). The medical benefits of spay/neuter have also been well described, including dramatic reductions in the risk of mammary carcinoma, elimination of cystic endometrial hyperplasia, pyometra and ovarian cancer in queens, and decreased risk of prostate disease in toms.⁵⁵ Thus spaying and neutering favors both individual as well as population health.

Proper Nutrition

Proper nutrition has a profound impact on wellness. Not only is it essential for management of healthy body weight and condition, good nutrition is also known to support immune function. A regular diet of palatable commercial food consistent with life stage should be offered, and fresh water must always be available. Although some cats tolerate changes in food without apparent problems, it is important to recognize that for others, changing from one diet to another can cause loss of appetite and/or gastrointestinal upset. For this reason, it is generally best to provide the most consistent diet possible.⁴⁹ Whereas this may be relatively easy to do in a laboratory or cattery setting, it can be more challenging in a shelter environment. Some pet food companies offer feeding programs for animal shelters, providing a consistent food for purchase at a special rate for shelters. However, some shelters rely heavily on donations of food. In this case, by requesting donation of certain brands of food, shelters are able to provide a consistent diet whenever possible. It is also feasible to mix donated foods with the shelter's usual diet to minimize problems caused by abrupt diet changes while taking advantage of other donated products.

Free Choice versus Meal Feeding

The wild ancestors of domestic cats hunted to eat, feeding up to 30 times in a 24-hour period. This style of feeding behavior is preferred by many domestic cats that would nibble throughout the day and night, consuming many small meals if left to their own devices. Although this is true, most cats are capable of adapting to either free choice or meal feeding as their daily feeding pattern.^{15,49} There are advantages and disadvantages to each in a population setting.

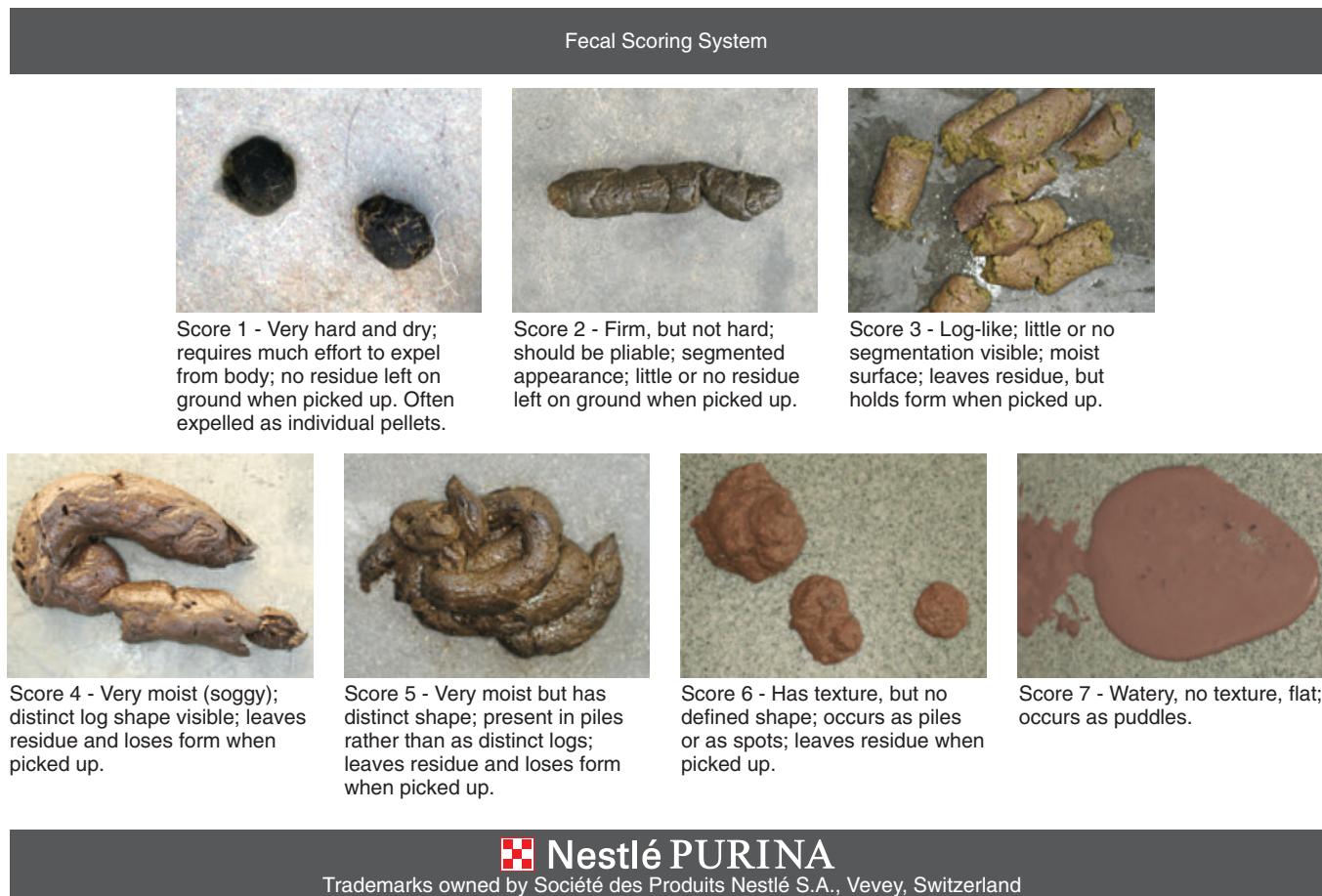
With free choice or *ad libitum* feeding, food is always available such that a cat can eat as much as he or she

wants whenever he or she chooses. Dry food is used for this method of feeding, because canned products left at room temperature are prone to spoiling. The major advantage of free choice feeding is that it is quick and easy: Caregivers simply need to ensure that fresh dry food is always available. Major disadvantages include the fact that cats that are not eating may remain unrecognized for several days, especially when more than one animal is fed together, and some cats may choose to continually overeat and become obese. Free choice feeding is an excellent method for cats that require frequent food consumption. These include kittens up to 5 to 6 months of age, queens in late gestation, and those that are nursing. Unlike dogs, who are competitive eaters by nature, free choice feeding may benefit cats that are group housed, because it ensures that there will be ample time for all members to eat, provided that dominant members of the colony do not block the access of subordinate cats.⁴⁹

Meal feeding using controlled portions of dry and/or canned food may be done as an alternative to or in conjunction with free choice feeding. When used alone, a minimum of two meals should be fed per day.⁴⁹ Meal feeding is ideal for any cat that requires controlled food intake and facilitates monitoring of appetite. Meal feeding also has the benefit of enhancing caregiver-cat bonding and provides a pleasant and predictable experience for cats when done on a regular daily schedule. Using a combination of free choice plus once daily meal feeding takes advantage of the positive aspects of both methods and works well for most cats in a population setting. Typically, dry food is available free choice, and a small meal of canned food is offered once daily. This combination approach accommodates the normal feeding behavior of cats by allowing them to eat several smaller meals throughout the day while allowing caregivers to monitor the cat's appetite at least for the canned food meal. As necessary for the individual cat, some may be fed additional meals of canned food to ensure adequate nutritional support.

Monitoring

Good body weight and condition and a healthy hair coat are evidence of an adequate nutritional plane and proper nutritional management. Both appetite and stool quality should be monitored daily. Normal stools should be well-formed and medium to dark brown. Adult cats typically defecate once daily, although healthy adults may defecate anywhere between twice a day and twice a week. Kittens tend to produce a larger volume of stool more frequently, which is often lighter in color and softer in form than that of adults. Simple scales can be used for monitoring appetite (e.g., good, some, none), and fecal scoring charts are available. The author recommends the Purina Fecal Scoring System chart available from Nestlé Purina PetCare Company (Figure 46-7).



 **Nestlé PURINA**

Trademarks owned by Société des Produits Nestlé S.A., Vevey, Switzerland

FIGURE 46-7 Fecal scoring system. (Courtesy Nestlé Purina.)

In addition to appetite and stool quality, it is essential to monitor body weight and condition. Body condition can be subjectively assessed by a process called body condition scoring, which involves assessing fat stores and, to a lesser extent, muscle mass. Fat cover is evaluated over the ribs, down the top line, tail base, and along the ventral abdomen and inguinal (groin) areas. Body condition score charts have been established on scales of 1 to 5 and 1 to 9. The author recommends use of the Purina body condition score chart which is based on a scale of 1 to 9 with 1 being emaciated and 9 being severely obese (see Figure 3-3).

Cats should be weighed and their body condition scored at routine intervals. Ideally, body weight should be recorded at entry to the population and then weekly during the initial month of care, after which it could be recorded once a month or more often as indicated based on the individual's condition. This is especially important for cats, because significant or even dramatic weight loss may be associated with stress or illness during the first few weeks of confinement in a new setting. On the other hand, in long-term-housed cats, excessive weight gain may occur in some individuals. Therefore protocols must be in place to identify and manage unhealthy

trends in body weight, because both weight loss and gain can compromise health and well-being.

Grooming

Appropriate grooming is also essential to ensure wellness and must never be considered as optional or purely cosmetic. Most cats require minimal grooming because of their fastidious nature. However, long-haired cats are notable exceptions, often experiencing matting of the hair coat without regular grooming sessions. Matted hair coats are not only uncomfortable for the animal, but may lead to skin infection. Overgrown nails can also be a problem for some cats, particularly those that are geriatric or polydactyl. The provision of appropriate surfaces for scratching will encourage cats to condition their own claws; and a system for regular inspection of the hair coat and nails should be established. In addition to ensuring proper coat and nail maintenance, regular grooming sessions provide an excellent opportunity to monitor body condition; and some cats enjoy the physical contact and attention. In high-risk settings, the use of stainless steel combs or undercoat rakes that can be readily disinfected are generally preferable to the use of

bristle brushes because the latter are impossible to disinfect and have the potential to spread common skin infections such as ringworm.

Periodontal Disease Prevention

Dental health is another component of wellness. In the context of population wellness, it may not be the highest priority; however, it should always be a consideration in terms of individual health care and well-being. This is important because periodontal disease will occur unless it is actively prevented, and plaque and tartar buildup may contribute to serious health concerns, ranging from oral pain to chronic intermittent bacteremia and organ failure. Feline tooth resorption and gingivostomatitis are also common conditions of the feline oral cavity that can lead to chronic pain, affecting the cat's appetite and ability to self-groom, and negatively impacting quality of life. When painful dental disease is present, a plan for timely treatment should be identified and implemented. Preventive dental care may include tooth brushing, dental-friendly diets, and treats and chew toys in combination with periodic professional dental care.³³ These should be tailored to meet the needs of individuals in the population to optimize dental health. Cats with stomatitis should be removed from breeding programs.⁷²

Breed-Specific Care

Wellness protocols may also be dictated by the specific needs of certain breeds of cats. For example, Persian, Himalayan, and other brachycephalic cats are predisposed to respiratory disease and tend to be more severely affected than other cats because of their poor airway conformation. Because of the high likelihood of exposure in a shelter setting, these cats should be housed in highly biosecure areas that are well ventilated and should be prioritized for immediate adoption or transfer to foster care or rescue.⁴¹ In the author's experience, even intranasal vaccination of these breeds can result in severe clinical signs of respiratory disease and is best avoided.

DEVELOPING A POPULATION WELLNESS PROGRAM: CONSIDERATIONS FOR BEHAVIORAL HEALTH

Just as a physical wellness program must be tailored to the population in question, a behavioral wellness program, composed of all of the essential elements, should be created to meet its specific needs as well. Even when animals will only be housed for short periods, considerations for behavioral care are essential to ensure humane care. Short-term confinement can induce severe stress and anxiety, and when confined long term, cats

may suffer from social isolation, inadequate mental stimulation, and lack of exercise. A behavioral wellness program should strive to decrease stress from the moment cats arrive at a facility until the moment that their stay ends. As previously described, a thorough behavioral history will provide an important baseline for action and follow-up.

Behavioral Care at Intake

Understanding the importance of minimizing stress in cats and possessing the ability to recognize and respond to it are essential to facilitate a cat's transition into a population.^{42,46} Staff should be trained to evaluate cats beginning at intake and to recognize and respond to indicators of stress. Active daily monitoring of cats for signs of stress or adjustment should be performed, and staff should record their findings daily, noting trends and making adjustments in the care of individual cats and the population as indicated.

In animal shelter environments, proper behavioral care of cats also requires an understanding of the wide spectrum of feline lifestyles and an approach tailored to the individual needs of each group. Domestic cat lifestyles and levels of tractability range from the most docile, sociable housecat, to free-roaming strays and truly unsocialized feral cats that will not allow handling. Stray cats include those that may have been previously owned or are "loosely owned" neighborhood or barn cats.⁷⁹

Because of their lack of socialization, capture, handling, and confinement are especially stressful for feral cats. However, fearful cats may resort to overt aggressive or may "teeter on the edge" of defensive aggression regardless of their socialization status. In fact, even the tamest house cats may exhibit the same behaviors as feral cats when they are highly stressed (Figure 46-8).^{29,42} These responses can compromise cat welfare and staff safety and hinder adaptation to a new environment.

Regardless of their demeanor, all cats and kittens should be provided with a hiding box in their enclosure at the time of entry, because the ability to hide has been shown to substantially reduce feline stress.¹⁴ For those cats that are severely stressed or reactive, covering the cage front, in addition to providing a hiding box, and posting signage to allow the cat "chill out" time for several hours or even a few days can facilitate adaptation.⁴² This is important because, once highly stressed or provoked, cats often remain reactive for a prolonged time and may become more reactive if they are stimulated again before they have been allowed a period of time to calm down.⁹

Soft bedding should be available for comfort and so that cats may establish a familiar scent, which aides in acclimation to a new environment. Care should be taken during cleaning procedures to minimize stress and noise,



FIGURE 46-8 The behavioral responses of pampered house cats and feral cats may be indistinguishable at the time of intake to an animal shelter. Two cats exhibit signs of severe stress and fear—crouched and withdrawn in the back of a cage with dilated pupils, feigning sleep. Note the presence of the second cat hiding behind the first. The provision of an appropriate hiding box could greatly aid stress reduction for these cats.

and cats should be allowed to hide while their cage is quietly tidied and replenished around them as needed. Commercially available “cat dens” are ideal for this purpose, because they can be secured from a safe distance such that the cat is closed inside a secure, familiar hiding place during cleaning procedures (Figure 46-9). Cats should be returned to the same cage and only spot cleaning should be performed to preserve their scent, which is necessary for stress reduction. If it becomes necessary to house the cat in another location, the den and towel should accompany the cat to ease the transition. Finally, the use of commercially available synthetic analogues of naturally occurring feline facial pheromones (Feliway, Veterinary Product laboratories, Phoenix, Ariz.) have been shown to be useful for stress reduction in cats during acclimation to new environments and can be sprayed onto bedding and allowed to dry prior to use or dispersed in the room using plug-in diffusers.⁴⁸

The way in which cats are handled at intake has a profound impact on their behavior, health, and well-being and will impact the cat’s ability to adapt to its new environment. When stress is successfully mitigated, cats are more likely to adapt and to “show their true colors” rather than reacting defensively. During a period of a few days, many cats that did not appear to be “friendly” at intake will become tractable and responsive to their human caregivers, facilitating care.⁴²

Behavioral Evaluation

Aside from informally “getting to know” cats during their initial acclimation period in a facility, a systematic



FIGURE 46-9 A commercially available feral cat den (ACES, Boulder, Colo.) serves as a secure hiding place for a cat. The circular door can be closed from a safe and nonthreatening distance while the cage is spot cleaned as needed. The cat can also be securely transported in the den.

behavioral evaluation may be useful, especially for cats that will be re-homed. Several evaluations have been recommended, but none are scientifically validated for predicting future behavior with certainty.^{3,103,107} Nonetheless, this form of evaluation may be useful for determining behavioral needs while cats remain in a facility, as well as guiding appropriate placement. Box 46-6 describes common components of a feline behavioral evaluation (Figure 46-10).

Proper Housing

Housing design and operation can literally make or break the health of a population.⁴⁵ Regardless of the species in question, housing should always include a comfortable resting area and allow animals to engage in species-typical behaviors while ensuring freedom from fear and distress.⁵⁴ It is not sufficient for the design to address only an animal’s physical needs (e.g., shelter, warmth). It must meet their behavioral needs as well, and both the structural and social environment are essential considerations for housing arrangements. Furthermore, the environment must provide opportunities for both physical and mental stimulation, which become increasingly important as length of stay increases.⁵⁴

A sense of control over conditions is well recognized as one of the most critical needs for behavioral health.⁷⁷ Thus housing design must provide cats with a variety of satisfying behavioral options. Specifically, housing arrangements must take into account the following feline behavioral needs⁴⁶:

- Opportunities for social interactions with humans and/or other compatible cats

BOX 46-6**Typical Components of a Formal Behavioral Evaluation for Cats^{3,103,107}**

Responses are observed and recorded for each of the following:

Cage Side Evaluation

- The tester approaches cage, stands quietly for 20 seconds, then offers verbal encouragement.
- If deemed safe to proceed, tester opens the cage door and calmly extends an open hand towards the cat, then attempts to gently touch the cat's head.
- If the caregiver is unsure if this is safe to do, a plastic hand may be used to gauge the cat's receptiveness to touch (see [Figure 46-9](#)).
- If the cat allows handling, the cat is gently lifted and carried to a secure, quiet room for further observation.

In-Room Evaluation

- The tester sits quietly on a chair and/or the floor; the tester calls and solicits the cat's attention.
- The tester pets the cat on the head.
- The tester strokes the cat down the back several times.
- The tester picks up the cat and hugs it for 2 seconds.
- With the cat standing on the floor, the tester strokes the cat down the back and firmly but gently grasps the base of the tail and lifts the cat off of its hind feet for 1 second. The tester repeats this a second time.
- The tester engages the cat in play with an interactive toy.

- The ability to create different functional areas in the living environments for elimination, resting, and eating
- The ability to hide in a secure place
- The ability to rest/sleep without being disturbed
- The ability to change locations within the environment, including using vertical space for perching
- The ability to regulate body temperature by moving to warmer or cooler surfaces in the environment
- The ability to scratch (which is necessary for claw health and stretching, as well as visual and scent marking)
- The ability to play and exercise at will
- The ability to acquire mental stimulation

Because these needs will vary depending upon such factors as life stage, personality, and prior socialization and experience, facilities should maintain a variety of housing styles in order to meet the individual needs of different cats in the population ([Figure 46-11](#)).⁴⁶

Feline Social Behavior

Managing housing arrangements for a population of cats of varying ages, genders, personality types, social experiences, and stress levels requires knowledge of normal feline social behavior and communication.⁴⁶ During the past 2 decades, knowledge of feline social structure has evolved from the widespread belief that cats are generally an asocial and solitary species to the realization that they are social creatures.^{24,25} With the exception of solitary hunting, free-roaming cats perform

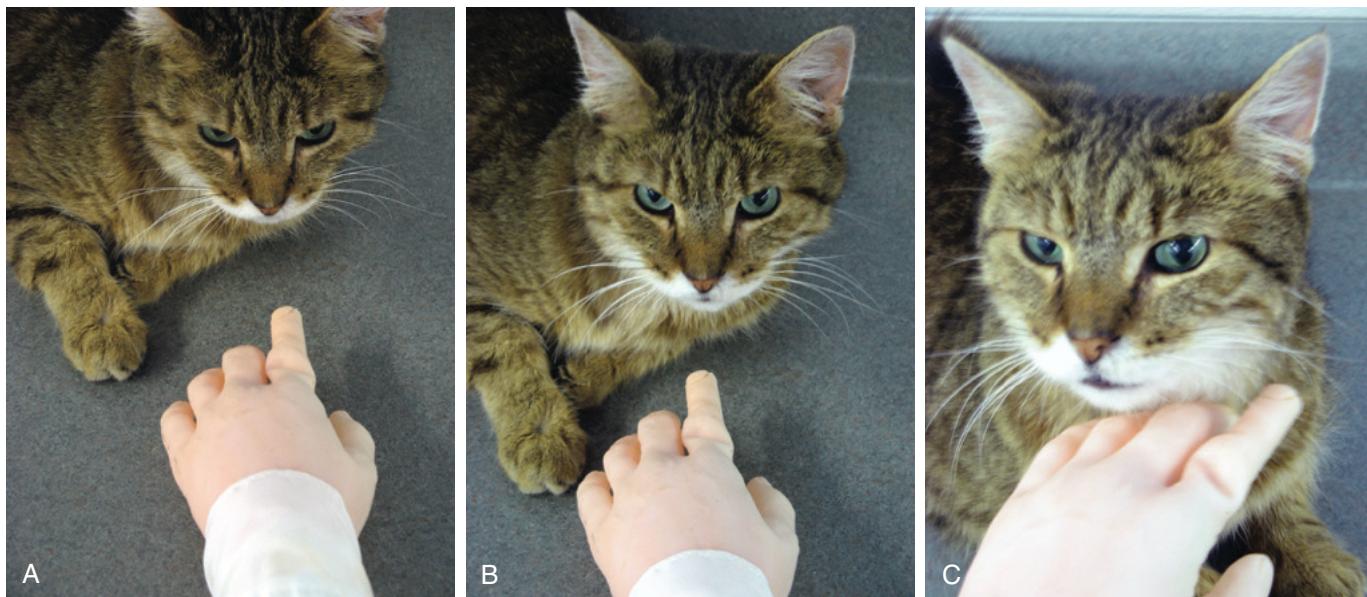


FIGURE 46-10 In some instances, it is difficult to determine if a cat will accept handling. To prevent injury to staff, a plastic hand (Assess-a-Hands; Great Dog Productions, Accord, NY) is used to approach this cat. As the hand approaches, the cat appears tense (A) but begins to relax and accepts petting (B and C).



FIGURE 46-11 A combination of free-standing runs and condo units are used to house cats awaiting adoption in an animal shelter. The availability of a variety of housing styles facilitates meeting the individual needs of various cats in the population.

most of their activities within stable social groups where cooperative defense, cooperative care of young, and a variety of affiliative behaviors are practiced. Affiliative behaviors are those that facilitate close proximity or contact. Cats within groups commonly practice mutual grooming and allorubbing (e.g., rubbing heads and faces together). This may serve as a greeting or as an exchange of odor for recognition, familiarization, marking, or development of a communal scent. Cats of both genders and all ages may exhibit affiliative behaviors, and bonded housemates often spend a large proportion of their time in close proximity to one another.⁸

Maternal behavior is the primary social pattern of the female cat, and cooperative nursing and kitten care are common. If allowed, queens form social groups along with their kittens and juvenile offspring.^{24,25} Tomcats typically reside within one group or roam between a few established groups. Within groups of cats, a social hierarchy or “pecking order” forms.^{24,90} Once established, this hierarchy helps to support peaceful co-existence of cats within a stable group, minimizing agonistic behaviors between members. Social hierarchy formation occurs within groups of cats that are sexually intact, as well as in those that are neutered.

Feline Communication and Behavioral Signs of Stress

Knowledge of behavioral signaling is critical for successful management of housing arrangements. Manifestations of both normal and abnormal behavior indicate how successfully an animal is coping with its environment. Common behavioral expressions of feline anxiety may manifest with inhibited or withdrawal behavior, defensive behavior or disruptive behavior.^{46,90} Inhibited or withdrawal behavior refers to activity depression or

BOX 46-7

Typical Behavioral Responses of a Cat Caged in a Novel Environment⁴⁶

- Fear is typically the initial response, and if threatened by the proximity of unfamiliar caregivers, defensive aggression may be displayed. Alternatively, the cat may freeze or appear cataleptic.
- If provided with a box for concealment, the cat will hide or otherwise slink against the back of the enclosure, behind the litter box, or disrupt the cage and hide under the paper.
- Given time, most cats become more active and engage in greeting behaviors, coming to the front of the cage and pawing or mewing as caregivers approach.
- If the cat remains confined with time without adequate periods of exercise, mental stimulation, and social companionship, stress and frustration will manifest with activity depression and withdrawal (lying in the litter box, failure to groom, failure to greet caregivers, and, in some cases, displaying aggression towards caregivers).
- Displays of stereotypic behavior (such as pacing) may occur; however, inhibited or withdrawal behaviors are much more common (see Figures 46-12 to 46-15).

the absence of normal behaviors (e.g., grooming, eating, sleeping, eliminating, stretching, greeting people). Defensive behavior may involve characteristic postural and/or vocal responses, and is usually motivated by fear. Disruptive behavior involves destruction of cage contents and creation of a hiding place. Stereotypic behaviors (e.g., repetitive pacing, pawing, and circling) may also develop as a result of stress but generally occur less commonly. As an illustration of these feline behaviors, consider the responses of a typical social domestic cat when caged in a novel environment (Box 46-7 and Figures 46-12 to 46-15).

Behavioral signs of stress may be further classified as active communication signals or passive behaviors.^{46,90} Signals of anxiety, fear, aggression, and submission may be subtle or obvious and include vocalization (growling, hissing), visual cues (facial expression, posturing of the body, ears, and tail), and scent marking (urine, feces, various glands of the skin).

Passive signs of stress include the inability to rest/sleep, feigned sleep, poor appetite, constant hiding, absence of grooming, activity depression (decreased play and exploratory behavior), and social withdrawal. High-density housing exacerbates these signs. Low-social-order cats in such an environment may exhibit decreased grooming, poor appetite, and silent estrus.⁴⁴ Cats that are consistently fearful or anxious may hide,



FIGURE 46-12 Feline stress commonly manifests with activity depression and social withdrawal. **A**, A caged cat exhibits signs of acute stress—crouched and withdrawn in the back of a cage with dilated pupils. **B**, Long-term cage confinement can result in frustration, activity withdrawal, and, in some cases, aggression. This cat lies helplessly in a cage with virtually no other behavioral options. Once friendly to caregivers, it may respond aggressively if handled. (From Griffin B, Hume KR: *Recognition and management of stress in housed cats*. In August JR, editor: *Consultations in feline internal medicine*, vol 5, St Louis, 2006, Elsevier, p 717.)

turn their back, huddle, and avert their eyes from the gaze of other cats. Hiding is a normal and important coping behavior; however, when hiding is occurring with increased frequency or in response to stimuli that did not previously cause hiding, it should be recognized as a sign of stress.^{46,90}

In group settings, the complexity of the social structure cannot be overestimated. The internal structure of social groups rarely represents a straightforward linear hierarchy, except in very small groups of less than four to five animals.²⁵ In larger groups of cats, there are usually one or two top-ranking individuals and one or two obvious subordinates, while the remaining cats share the middle space.^{9,44} Most cats within the group form affiliative or friendly relationships; however, some may fail to form such relationships and remain solitary. Colony members commonly display aggression toward



FIGURE 46-13 A stressed cat exhibits a marked fear response when caged and confronted. Note the frozen stance, dilated pupils, and sideways, flattened ears. If approached more closely, the cat would likely respond with defensive aggression if an escape route were not available. (From Griffin B, Hume KR: *Recognition and management of stress in housed cats*. In August JR, editor: *Consultations in feline internal medicine*, vol 5, St Louis, 2006, Elsevier, p 717.)



FIGURE 46-14 When caged in a novel environment, a typical response for a cat is to disrupt the cage contents and create a hiding place. (From Griffin B, Hume KR: *Recognition and management of stress in housed cats*. In August JR, editor: *Consultations in feline internal medicine*, vol 5, St Louis, 2006, Elsevier, p 717.)

unfamiliar or new cats entering the group. Within an established group, however, most social conflicts are not characterized by overt aggression. Instead, the main mode of conflict resolution is avoidance or deference (Figure 46-16).^{9,46,90} Deference behaviors include looking away, lowering the ears slightly, turning the head away, and leaning backward. Large numbers of cats peacefully co-exist together, using such strategies for avoidance provided ample space and resources are available for all members of the group.¹⁰

Signs of social stress within groups of cats may manifest with overt aggression, increased spraying and



FIGURE 46-15 Hiding is frequently the initial response (A), but after a short period, many cats will solicit the attention of onlookers by pawing at the cage front (B).



FIGURE 46-16 The major modes of conflict resolution for cats are deference and avoidance. A, An inquisitive cat (left) approaches a wary cat (right). B, The wary cat exhibits an offensive warning, signaling the approaching cat to stay away. C, Overt combat does not ensue, instead the cat on the left defers by simply sitting down a safe distance away. (From Griffin B, Hume KR: Recognition and management of stress in housed cats. In August JR, editor: Consultations in feline internal medicine, vol 5, St Louis, 2006, Elsevier, p 717.)

marking, or constant hiding.^{46,90} Lower-ranking cats may spend little time on the floor, remaining isolated on single perches or other locations where they may even eliminate, while higher-ranking cats remain more mobile, controlling access to food, water, and litter resources.⁴⁴ High-density housing conditions frequently result in such abnormal behaviors and are associated with increases in transmission of infectious diseases and reproductive failure as well.⁵⁰

Types of Housing Arrangements

Cats are commonly housed in three basic arrangements: cage or condo units, multiple runs within a room, or free ranging in a room.⁴⁵ Cage housing of cats should be avoided unless necessary for short periods for intake observation, legal holding periods in shelters as required by local ordinances, medical treatment or recovery, or to permit sample collection.⁴⁵ Although space recommendations vary substantially in the literature, common



FIGURE 46-17 This housing arrangement is inadequate for the occupant. The small cage does not allow for an appropriately sized litter box, and there is not sufficient space for the cat to rest, move about, or hide.

sense dictates that a determination of necessary housing space should take into account the cat's length of stay. In the author's opinion, it is neither appropriate nor humane to house cats in traditional cage housing long term (e.g., more than 1 to 2 weeks).

Short-Term Housing

The design of short-term housing should include provisions for housing individual animals, litters, families, or bonded housemates for intake evaluation and triage.⁴¹ Housing must be easy to clean and sanitize, well ventilated, and safe for animals and caregivers. Short-term housing should provide sufficient space to comfortably stand, stretch, and walk several steps; sit or lay at full body length; and separate elimination, feeding, and resting areas. Litter boxes should be of appropriate size to comfortably accommodate the cats for which they are intended (Figure 46-17). Resting areas should include comfortable surfaces, soft bedding, and a secure hiding place to provide a safe refuge.⁴¹ A hiding place is essential, because it reduces stress by allowing cats to "escape," facilitating adaptation to a new environment. The addition of a sturdy box to a cage will provide a hiding place as well as a perch (Figures 46-18 and 46-19). In addition, cages should be elevated off of the floor by at least 0.5 m (1.5 feet), because this serves to reduce stress as well.⁷³

SIZE OF ENCLOSURES

In most instances, cage or condo style housing is used in most facilities for short-term holding at intake for observation, acclimation, and/or triage. Runs or small rooms are also appropriate for intake housing, and offer cats the obvious benefit of additional space to meet their behavioral needs (Figure 46-20). Regardless of their configuration, enclosures for short-term housing of cats



FIGURE 46-18 Traditional cage housing can be enhanced by the provision of proper resting perches and hiding places that divide the space into different functional living areas. Placement of a purpose-made cardboard box (Hide, Perch and Go Box, British Columbia Society for the Prevention of Cruelty to Animals) improves the quality of the space and the welfare of the cat. This box also folds into a transport carrier.



FIGURE 46-19 A perch and a bed are required for every cat, no matter what the housing arrangement. Portable perch-beds (Kuranda Cat Bed, Glen Burnie, Md.) can accompany the cat from intake cages to long-term housing to ease the transition to a new environment.

should be large enough to allow them to stretch, groom, and move about while maintaining separate functional areas, at least 0.6 m (2 feet) apart, for sleeping, eating, and elimination.^{41,58,98}

Laboratory guidelines in the United States call for a minimum floor area of 0.27 m^2 (3 ft^2) for cats weighing less than 4 kg and 0.36 m^2 (4 ft^2) for cats weighing 4 kg or more, with a minimum height 0.6 m (2 ft).⁵⁴ A resting



FIGURE 46-20 Single enriched housing in a 4 × 6 ft room for a shy cat during an acclimation period to a new facility. Note the multiple resting areas available and the use of a commercially available feline facial pheromone plug-in diffuser (Feliway, Veterinary Product Laboratories, Phoenix, Ariz.). The screen door facilitates ventilation as well as olfactory exchange.

perch is also required. Current guidelines (European Convention for the Protection of Vertebrate Animals Used for Experimental and Other Scientific Purposes, ETS123) promulgated by the Council of Europe (<http://www.coe.int>) for laboratory cats are similar, but proposed revisions call for substantially more floor space for cats, at 1.5 m^2 (16.7 ft 2) per adult cat with a height of at least 2 m (6.5 ft).^{21,22} The revisions, which have not been approved to date, also call for the provision of shelves, a box-style bed, and a vertical scratching surface. Animal shelter facilities in the United States have traditionally been equipped with small perchless cages (e.g., 0.5 to 0.75 m or 1.5 to 2.5 ft long) that are poorly designed for housing cats. The Association of Shelter Veterinarians (<http://www.sheltervet.org>) recommends a minimum enclosure size of 1 m^2 (11 ft 2) for adult cats.⁷ Commercially available cages are typically approximately 0.75 m (2.5 ft) deep (e.g., an arm-length deep so that they can be readily accessed); therefore a cage with a length of 1.2 m (4 ft) is required to provide this approximate square footage, and it will also allow for adequate separation of food, water, and litter (Figure 46-21). Similarly, the Cat Fanciers' Association (<http://www.cfa.org>) recommends a minimum of 0.85 m^3 (30 ft 3) of space per cat for those weighing 2 kg or more.¹⁶ Cubic measurements take into account the use of vertical space in addition to floor space, which is crucial for improving the quality of the environment. For example, a 0.85-m^3 (30-ft 3) enclosure would measure approximately 0.75 m deep × 1.2 m wide × 1 m high (2.5 ft deep × 4 ft wide × 3 ft high).

Larger enclosures also allow for better air circulation, which is an important consideration for control of feline



FIGURE 46-21 Appropriate short-term (e.g., less than 2 weeks) housing for a single cat. Note the large 4-ft long cage, provision of a secure hiding place and perch with bed, separation of litter from resting and feeding areas, and appropriately sized litter box for this large cat.



FIGURE 46-22 A variety of commercially available condo-style housing units are available for cats and serve to separate functional living areas and provide improved opportunities for exercise and exploration. This unit (Tristar Metals, Boyd, Tex.) is constructed of powder-coated stainless steel, which is highly durable and easy to disinfect but less noisy than uncoated stainless steel. Note the elevation from the floor and the grills on both the front and back, which allows flow-through ventilation.

upper respiratory infections. Double-sided enclosures (e.g., cat condos) are ideal for meeting these specifications and have the benefit of easily allowing cats to remain securely in one side of the enclosure while the opposite side is cleaned (Figure 46-22). This helps to minimize stress, prevent exposure to infectious disease,



FIGURE 46-23 A and B, Conversion of existing cages into condo-style units. A hole is cut through the walls of adjacent cages and a section of polyvinylchloride (PVC) pipe with corresponding rims are used to create a safe portal for passage between the cages.

and preserve staff safety, which are especially crucial for newly arrived cats. Traditional cages can be modified into condo-style enclosures by creating portals to adjoin two or three smaller cages (Figure 46-23).

Regardless of the precise specifications of the enclosures, the importance of the overall quality of the living environment cannot be overemphasized. This includes a holistic approach to husbandry, with careful attention to the way in which cats are handled, noise levels, the provision of creature comforts, positive contact with caregivers, and strict avoidance of overcrowding, as well as good sanitation, medical protocols, and careful monitoring to ensure health and welfare.

Long-Term Housing

For long-term housing (e.g., greater than 2 weeks), consideration should also be given to providing space that

is both mentally and physically stimulating for cats and preferably that which is esthetically pleasing to humans.⁴¹ The latter is an important consideration to facilitate adoption in animal shelters. And, even in other types of facilities, it is important to create a pleasant environment not only for the animals, but also for their caregivers. Studies indicate that employee satisfaction improves animal care and staff retention, both of which may positively impact population health and well-being.⁹⁵

For long-term housing of cats alternatives to traditional cage housing should be afforded.^{41,45,46} At an absolute minimum, cats that are cage housed must be released each day and allowed an opportunity to exercise and explore in a secure enriched setting. For long-term housing, most cats will benefit from colony-style housing, provided there is sufficient space, easy access to feeding and elimination areas, an adequate number of comfortable hiding, and resting places and careful grouping and monitoring to ensure social compatibility among cats. Not every cat, however, will thrive in a group setting, and certain individuals will require enriched single housing, depending on their unique physical or behavioral needs. These may include cats that bully other cats or are otherwise incompatible and those with special medical needs. It is important to recognize that such singly housed cats will require more regular contact with their human caregivers and higher levels of mental and physical stimulation in order to maintain behavioral health during long-term confinement. Whenever possible, long-term housing of such individuals should be avoided. When cats are housed in amicable groups, it is easier to maintain proper behavioral welfare in the long term, because many of their social and emotional needs can be met by conspecifics.

Group Housing (Colony-Style Housing)

Group housing affords cats with opportunities for healthy social contact with others, which, in turn, provides additional mental and physical stimulation. When properly managed, this housing arrangement enhances welfare.* Insufficient space and crowding or poor compatibility matching of cats serves to increase stress and negates the benefits of the colony environment. Group housing should never be used as a means of simply expanding the holding capacity of a facility.

In animal shelters, the high turnover rate of cats contributes substantially to feline stress levels, especially in the context of groups of unfamiliar animals. Because it may take days to weeks to acclimate to a group environment, enriched individual housing may be preferable when a brief stay is anticipated. However, the benefits of enriched social group housing become evident when stays extend beyond a few weeks.⁴¹

*References 28, 45, 46, 57, 59, 70, 71, 74, 90, 98, 99.

SELECTION CRITERIA

Careful attention to groupings of cats is essential for success. Family groups and previously bonded housemates are natural choices for co-housing,^{11,46} but unfamiliar cats may also be grouped using careful selection criteria. Many cats do have preferences for housemates, necessitating conscientious compatibility matching combined with the provision of a high-quality environment. Groupings of unfamiliar cats should always be given priority for the largest available enclosures. In addition, cats should always receive appropriate health clearances prior to admission to a group. These should be determined by the specific protocols of the facility; but in most cases, minimum requirements would include that cats be free of signs of contagious disease, tested for FeLV and FIV, vaccinated against FVRCP, and treated for parasites.

In addition to prior relationships, selection criteria for groupings should include age, reproductive status, and personality.

AGE Age is an important consideration regarding housing arrangements.⁴⁶ To ensure proper social and emotional development, kittens should be housed with their mother at least until they are weaned. Because it can be behaviorally beneficial, it is desirable for them to remain with her for a longer period of time when this is feasible. In fact, queens frequently do not fully wean their kittens until 12 to 14 weeks of age if left to their own devices. If older kittens are housed with their mother, it is important to provide a perch that allows her the option of periodically resting away from them if desired. Most queens will accept the kittens of another cat; therefore young orphan or singleton kittens should be housed with other lactating queens and/or kittens of similar age/size. In a shelter setting where there is a high turnover of cats, it may be beneficial to house young kittens up to 4 to 5 months of age in large cages or condos for biosecurity purposes. Juveniles and adults can be housed in colony rooms or runs but should be segregated by age (e.g., juveniles 5 to 12 months old, young adults, mature adults, geriatrics). Well-socialized juveniles tend to adapt quickly in a group setting with other cats of similar ages and exhibit healthy activity and play behavior. In contrast, mature adults and geriatric cats often have little tolerance for the high energy and playful antics of many younger cats, which can cause them substantial stress. For this reason, adult cats should be kept separate from juvenile cats, and aging or geriatric cats separate from other age groups. In animal shelters, compatible cats that enter the shelter together should be housed together regardless of age, whenever possible.

REPRODUCTIVE STATUS Unless cats will be used for breeding, group housing of sexually intact cats of

breeding age should be avoided whenever possible. At a minimum, mature tomcats should be neutered to prevent intermale aggression, urine spraying, and breeding.⁴¹ Reproductively intact females may be co-housed with other intact females or with neutered males. In contrast, in breeding colonies, harem-style housing may be used to facilitate breeding (e.g., a few queens with a tomcat). It is also advantageous to house compatible pregnant queens together before delivery, because they will usually share nursing and neonatal care (Figure 46-24).⁴⁵ After delivery, pairing of queens becomes more difficult. When tomcats are not breeding, they can usually be co-housed with a spayed female, a neutered male, or a compatible juvenile for companionship. Other recommended groupings in the context of a breeding colony include postweaning family groups, prepubertal juveniles, or compatible single-sex adults.

PERSONALITY TYPE There are two basic feline personality types: cats that are outgoing, confident, and sociable and those that are relatively timid and shy.¹⁰⁵ Cats with bold, friendly temperaments tend to cope and adapt more readily than shy, timid cats. A subset of the bold, friendly personality type is the “assertive” or “bully” cat.⁹⁰ Bully cats constantly threaten other cats in a group setting in order to control access to food, litter, perches, or the attention of human caregivers. To maintain harmony, removing cats of this personality type from a colony is usually necessary. Reassignment is possible, but may prove difficult, necessitating single housing. Shy, timid cats sometimes have difficulty interacting successfully with more dominant members of a group or may fall victim to a bully, resulting in chronic stress and increased hiding. Placement of shy cats in smaller groups or with calm juvenile cats, where they will not be intimidated or harassed, is generally rewarding and often helps them to “come out of their shells.”^{46,90} Similarly, dominant cats will often accept calm, younger cats, as opposed to other adults by whom they may feel threatened. And finally, in the case of some dominant males, the introduction of a female cat will be more likely to be successful.^{46,64,90}

GROUP SIZE AND SPACE

The precise space requirements for long-term housing of cats will vary, because it is dependent on many factors (Box 46-8).^{46,59} Of paramount importance is that group size must be small enough to prevent negative interactions among cats and to permit daily monitoring of individuals. Cats typically prevent social conflict through avoidance, and adequate space must be available so that cats can maintain social distance as needed. Crowding can make it impossible for animals to maintain healthy behavioral distance, creating situations where individuals may not be able to freely access feeding, resting, or elimination space because of social conflicts over colony



A



B

FIGURE 46-24 In breeding colonies, compatible pregnant queens may be housed together prior to delivery. **A**, Two queens share the care of their litters of kittens. **B**, Perches should be provided so that mother cats can periodically seek respite if they choose. (From Griffin B, Hume KR: *Recognition and management of stress in housed cats*. In August JR, editor: *Consultations in feline internal medicine*, vol 5, St Louis, 2006, Elsevier, p 717.)

resources. Both crowding and constant introduction of new cats induce stress and must be avoided to ensure proper welfare. The addition of new cats always results in a period of stress for the group, and if there is constant turnover within the group, cats may remain stressed indefinitely. High turnover also increases the risk of infectious disease. If cat group numbers are small, disease exposure will be limited, facilitating control. For

BOX 46-8

Factors Influencing Spatial Needs of Housed Cats^{46,59}

- Length of stay
- Overall quality of the environment, including use of vertical space
- Overall quality of behavioral care
- Physical and behavioral characteristics of the cat (e.g., age, personality type, prior experience, and socialization)
- Individual relationships between cats (e.g., family groupings, previously bonded housemates, versus unfamiliar groupings and degree of social compatibility among cats)
- Turnover of cats (e.g., frequency of introduction of new members)
- Total room size
- Absolute number of cats
- Individual needs and levels of enrichment being used to meet these needs

all of these reasons, housing cats in small groups is preferred.^{41,45,46}

In most instances, the author recommends housing cats in compatible pairs or small groups of not more than three to four individuals. Housing cats in runs is ideal for this purpose (Figure 46-25). A well-equipped, 1.2- × 1.8-m (4- × 6-ft) run can comfortably house two to three adult cats depending on their familiarity and compatibility, or up to four juveniles (e.g., 6 to 12 months old). Juveniles tend to accept a slightly higher housing density than adults. Likewise, previously bonded housemates and families will generally peacefully co-exist at a higher density than will unfamiliar cats. When runs are used, they must have a top panel and should be at least 1.8 m (6 ft) high to allow caregivers easy access for cleaning and care. If chain-link is used, 2.5-cm (1-inch) mesh is ideal, but larger mesh can be used. Existing dog kennel runs can be converted into areas for cat housing. This is an important and practical consideration in animal shelters, because many shelters have experienced a decrease in dog intake, while the need for improved cat housing is great. Cats and dogs should never be co-housed in the same area; thus conversion should result in an exclusive cat housing area.

For colony rooms, the author recommends a minimum enclosure size of approximately 3 to 3.5 m × 5 to 5.5 m (10 to 12 ft × 16 to 18 ft) for colonies of up to a maximum of eight adult cats, or in the case of juveniles, a few more. Doubling the size of an enclosure does not necessarily allow a twofold increase in the number of cats that can be properly housed. Another author recommends 1.7 m² (18 ft²) per cat as a general guideline for group housing,



FIGURE 46-25 A, This 4- × 6-ft run has been appropriately outfitted for pair-housing of two adult cats. Note the multiple separate areas for resting, perching, hiding, feeding, eliminating, scratching, and playing. B, Cats enjoy the increased behavioral options provided by run-style housing.

acknowledging that many factors influence the spatial needs of cats, including the overall quality of the environment as well as the relationships of the individual animals.⁵⁹

In sanctuary and laboratory situations where cats are housed for months to years in stable colonies, larger groupings of cats may be feasible, provided ample space is available.⁴⁶ Housing arrangements can also be created in which individual enclosures are maintained within a colony room. In this case, cats could be allowed to wander and interact freely in the colony room by day but be confined to their respective enclosures at night,

enabling caregivers to better monitor individual appetites and litter box results while allowing cats a period of rest away from one another. Alternatively, individual enclosures may only be used for brief periods for meal feedings of canned food, with dry food available free choice in the colony. This sort of arrangement can also be used to facilitate introduction of new cats to the group and represents a desirable option. If design and biosecurity procedures permit, portable intake enclosures could even be transferred to group rooms to smooth the transition of new cats from intake to long-term housing areas.

INTRODUCTION OF NEW CATS

Tremendous individual variation exists among cats in the context of social relations with other cats. Although introduction of some previously unfamiliar cats will seem effortless and uneventful, introduction of others will result in considerable stress, not only for the new cat but for the entire group as well.⁴⁶ For this reason, introductions should always be done under supervision, and whenever possible, they should be gradual. To accomplish this, a new cat can be kept in a separate cage within or adjacent to the group enclosure equipped with food, water, litter, and a hiding box. Usually, within a few days, it will be evident by the behaviors of the cats whether or not the new cat can be transferred into the group enclosure without risk of fighting. Well-socialized kittens and juvenile cats frequently adapt readily to group accommodations, and prolonged introductions may not be necessary unless they are shy or undersocialized.

In established groups of cats, the introduction or removal of individuals will require a period of adjustment and may result in signs of social stress for members of the colony. These signs usually subside once a new social hierarchy and territorial limits (usually favored resting places) are established. In some cases, arrangement of incompatible cats, even within visible distance of one another, may create substantial anxiety, necessitating rearrangement (Figure 46-26). In the case of animal shelters, where population interchange is high, it is generally not feasible to maintain consistent groupings of cats. This underscores the absolute necessity of careful selection and compatibility matching, as well as maintaining a variety of housing styles. Even in modestly populated, carefully introduced, environmentally enriched colonies, behavior problems may occur. For this reason, some facilities elect to use an “all in–all out” approach to avoid repeated introductions of new cats into stable groups. In animal shelters, bonded pairs and family groupings of cats frequently enter the shelter together and are usually perfect choices for co-housing.⁴⁶

Because cats do have strong preferences for new roommates, caregivers must expect to find many that are incompatible as roommates. If only one or two cats are responsible for social destabilization of a group, they can



FIGURE 46-26 In some instances, arrangement or location of enclosures where cats are within visual contact of others may induce stress and anxiety, even though they are not housed in the same enclosure. This caged cat has been isolated from the group, yet remains stressed and threatened by the stares of the on-looking cat.

usually be reassigned to another colony, because it is often the social grouping, not the individual, that is the problem. If a cat shows persistent incompatibility with other cats, he or she should be housed singly. Studies indicate that cats that fight at the time of initial introduction are nearly 40 times more likely to continue fighting in the following weeks and months.⁶¹ If overt fighting occurs, cats should be permanently separated. Co-housing of incompatible cats or cats that fight is unacceptable.

COLONY LIVING ENVIRONMENT

The success of group housing depends not only on selection of compatible cats and the size of the enclosure but also on the quality of the environment.* A variety of elevated resting perches and hiding boxes should be provided to increase the size and complexity of the enclosure and to separate it into different functional areas, allowing a variety of behavioral choices. The physical environment should include opportunities for hiding, playing, scratching, climbing, resting, feeding, and eliminating. Whenever possible, a minimum of 1 litter box and 1 food and water bowl should be provided per 2 to 3 cats and arranged in different locations of the colony space, taking care to separate food and water from litter by at least 0.6 m (2 ft). In addition, placement should allow cats to access each resource from more than one side, whenever possible, without blocking access to doorways. Litter boxes should not be covered, to allow easy access and to prevent entrapment or ambush by other cats. The number of resting boards and perches



FIGURE 46-27 Cats enjoying a sunny window in a colony room at an animal shelter.

should exceed the number of cats and should be arranged in as many locations within the enclosure as possible. Open single perches should be separated by at least 0.6 m (2 ft) or staggered at different heights to ensure adequate separation, while larger perches should be available for cats who choose to rest together in close proximity. Many cats enjoy hammock-style perches or semienclosed box-style perches where they can hide. If there are not enough comfortable, desirable resting and hiding places, cats may choose to lie in litter boxes. Comfortable bedding (that is either disposable or can be easily laundered) should be provided. Not only do cats demonstrate preferences for resting on soft surfaces, they experience longer periods of normal deep sleep with soft bedding.²³ The environmental temperature should be kept comfortable and constant, and living quarters should be well ventilated, without drafts. By changing location within the colony (e.g., from the cooler surface of the floor to a sunny window), cats should be able to choose the environmental condition they prefer (Figure 46-27).⁴⁶

In colony rooms, installation of stairs, shelves, and walkways are ideal for increasing the use of vertical space (Figure 46-28). In larger rooms, installation of free-standing towers provides additional living and activity space and contributes to functionally reducing overcrowding (Figure 46-29). Depending on the setting, it may not be desirable for cats to access areas above the level of an arm's reach so that cleaning is easy and cats can be easily retrieved from the highest perches if needed. Colony room design should also ensure that cats cannot easily escape. In some cases, constructing a foyer at the entrance to the room will be necessary to minimize the risk of escape when the room is entered (Figure 46-30). In addition, ceilings should be constructed of solid surfaces, because cats can easily dislodge the

*References 28, 45, 46, 57, 59, 60, 70, 71, 74, 89, 90, 97-99.



FIGURE 46-28 A and B, Installation of stairs, shelves, and walkways can be used to create additional function space and is visually appealing, creating an inviting environment for both cats and humans.

panels typically used for dropped ceilings, and escape into the rafters (Figure 46-31).⁴⁶

Social Companionship

In addition to contact with conspecifics, cats must be afforded time for pleasant daily contact with human caregivers. As previously discussed, daily social contact and exercise sessions with humans are especially important for individually caged cats. Although social contact is usually highly desirable, it is not invariably pleasant for all cats. Personality, socialization, previous experience, and familiarity contribute to whether or not social interactions are perceived as pleasurable, stressful, or somewhere in between.^{46,77}



FIGURE 46-29 In larger colony rooms, free-standing towers (Kuranda Cat Tower, Glen Burnie, Md.) can be used to create additional functional space in the interior of the room.

Social Contact with Animal Care Staff

The importance of a cat-savvy staff that enjoys working with cats cannot be overemphasized. Animal care staff must be willing to spend quality time interacting with cats to assure socialization and tractability.^{45,46} Whenever possible, caregivers should be assigned to care for the same cats on a regular basis so that they become aware of the personality of each individual cat, which is necessary for detection of health problems, incompatibilities between cats, and, in the case of breeding colonies, estrous cycling. This is also important, because not all cats uniformly enjoy human companionship and will be more likely to be stressed by the presence of different caregivers, rather than becoming familiar and more at ease with one. In general, regular daily contact and socialization is essential to ensure that cats are docile, easy to work with, and have no fear of humans. Caregivers should schedule time each day to interact with “their” cats aside from the activities of feeding and cleaning. Some cats may prefer to be petted and handled, while others prefer to interact with caregivers by playing with toys (Figure 46-32).

In particular, human contact is essential for proper socialization of young kittens. A sensitive period of socialization occurs during the development of all infant animals, during which social attachments to members of the same species and other species form easily and rapidly. In kittens, the sensitive period of socialization occurs between 2 and 7 weeks of age, and cats not properly socialized to humans during this time may never permit handling.^{75,105} Beginning shortly after birth, kittens should be handled daily, talked to in a soothing



FIGURE 46-30 **A**, For colony room housing, the construction of a chain-link foyer at the entrance to the room prevents cats from escaping when the room door is opened. **B**, Inexpensive milk crates attached with zip ties create areas for climbing and perching on the chain-link wall. (From Griffin B, Hume KR: *Recognition and management of stress in housed cats*. In August JR, editor: *Consultations in feline internal medicine*, vol 5, St Louis, 2006, Elsevier, p 717.)



FIGURE 46-31 A solid-surface ceiling is essential in free-range housing rooms to prevent the escape of cats into the rafters. Once in the ceiling, cats may be difficult to recover, and injury and/or damage to the facilities may result. (From Griffin B, Hume KR: *Recognition and management of stress in housed cats*. In August JR, editor: *Consultations in feline internal medicine*, vol 5, St Louis, 2006, Elsevier, p 717.)



FIGURE 46-32 **A** and **B**, Daily social contact with humans aside from cleaning and feeding activities is essential for behavioral welfare. Cats may enjoy petting, grooming, or interaction with toys.



FIGURE 46-33 Cats surround a water fountain in this example of enrichment.



FIGURE 46-34 A and B, Enrichment does not have to be complicated or expensive. In this case, a cat enjoys watching soap bubbles blown by a caregiver.

voice, gently petted, and held. Interactions should include play (stimulated with toys) as the kittens become ambulatory. For kittens housed in a shelter, socialization must always be balanced with infectious disease control, and caregivers should take precautions accordingly.

Mental and Physical Stimulation

Other forms of stimulation, including those that engage the various senses, are important methods of enriching the living environment by promoting healthy mental and physical activity. For singly housed cats and long-term residents, appropriate levels of additional enrichment should be provided on a daily basis.

Visual Stimulation

The provision of birdfeeders, gardens, or other interesting stimuli in the external environment can enhance the internal environment of the colony. Resting perches in view of windows or other pleasant areas of the facility are especially desirable. Other novel and enriching visual stimuli include cat-proof aquariums with fish, water fountains, bubbles, perpetual motion devices, and videos especially designed for cats (Figures 46-33 to 46-35).³²

Auditory Stimulation

A radio playing soft, low music in the room provides a welcome distraction and important source of



FIGURE 46-35 A shelter cat watches a specially produced feline video (Video Catnip, Pet Avision, Lyndon Center, Vt.). Provision of adequate mental stimulation is essential for behavioral wellness. (From Griffin B, Hume KR: *Recognition and management of stress in housed cats*. In August JR, editor: *Consultations in feline internal medicine*, vol 5, St Louis, 2006, Elsevier, p 717.)

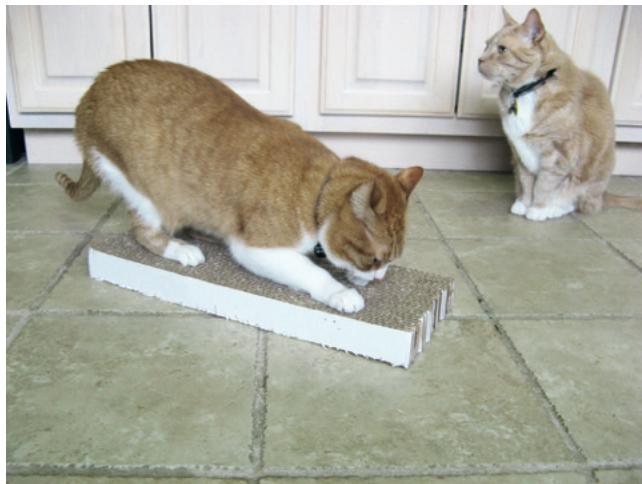


FIGURE 46-36 Disposable, corrugated cardboard cat scratcher. Scratching is an essential need of all cats. It conditions the claws and serves as an important means of feline communication through both visual and scent marking.

stimulation. In addition, it may help to habituate cats to human voices and prevent them from being startled by loud noises. Most caregivers also enjoy listening to the radio, and happy caregivers create a relaxed environment.⁴⁵

Tactile Stimulation

The provision of scratching boards is especially important, and a variety of sturdy surfaces, both horizontal and vertical, should be provided for scratching. Sisal rope, the backs of carpet squares, and corrugated cardboard are all useful (Figure 46-36).

Olfactory Stimulation

Many cats like to smell and chew grass, and containers of cat grass or catnip can be introduced for brief periods to stimulate activity (Figure 46-37).

Feeding Enrichment

Providing novel sources of food is another important source of stimulation and can be easily accomplished by hiding food in commercially available food-puzzle toys or in cardboard boxes or similar items with holes such that the cat has to work to extract pieces of food (Figure 46-38).^{46,102}

Positive Reinforcement-Based Training

Obedience training using clickers with food rewards is an excellent form of enrichment, combining social contact with caregivers together with both mental and physical stimulation. Positive reinforcement training using a target stick is a powerful tool for teaching shy cats to approach the front of an enclosure. Teaching cats awaiting adoption to perform tricks is not only stimulating for them, but it often makes them more attractive to potential adopters (Figure 46-39).



FIGURE 46-37 Olfactory stimulation is another important source of sensory enrichment. Many cats like to smell and chew grass, and containers of cat grass or catnip can be introduced for brief periods to stimulate activity.



FIGURE 46-38 Cats surround a variety of food puzzle toys (a ball, a cardboard tube, and a plastic container with holes). Treats are hidden inside, and they will have to work to extract pieces of food. Novel feeding is an excellent source of enrichment for cats that are housed long term.

Physical Stimulation

Play items that stimulate prey drive and physical activity, such as plastic balls, rings, hanging ropes, spring-mounted toys, plastic wands, and catnip toys, should also be provided but must be either sanitizable or disposable. Empty cardboard boxes and paper bags are inexpensive, disposable, and stimulate exploration and play behavior as well as scratching. Cats tend to be most stimulated by active toys, including wiggling ropes, wands with feathers, kitty fishing poles, and toys that can be slid or rolled to chase.⁸¹ Many cats enjoy chasing

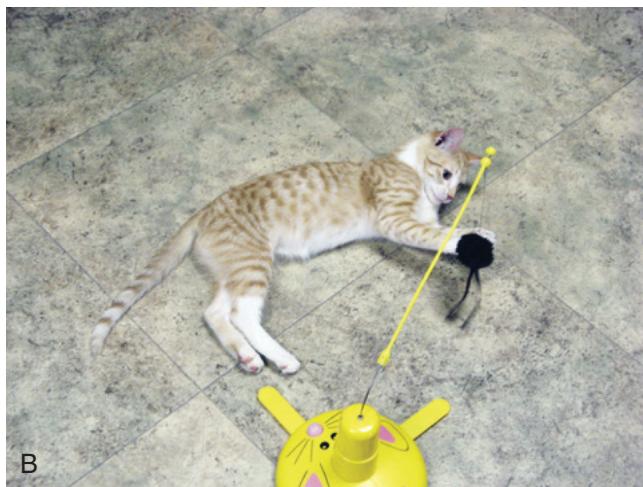


FIGURE 46-39 A and B, A juvenile cat watches and captures the toy at the end of the robotic arm. Commercially available electronic toys (Panic Mouse, Temecula, Calif.) may be used to stimulate mental and physical activity. By turning the toy on at the same time each day, cats can anticipate a predictable pleasant experience in their daily routine.

the beams of laser pointers, small flashlights, or suspended rotating disco balls. Commercially available electronic toys that stimulate play are especially useful in long-term settings (Figure 46-40). Varied toys should be substituted regularly to ensure continued interest.⁴⁶

Outdoor Access

In some climates, cats may be housed comfortably in outdoor enclosures where fresh air, sunshine, and other stimuli can help to create a healthy environment (Figures 46-41 and 46-42).^{46,60,71} When indoor group enclosures connect to outdoor enclosures, it is important to have ample space for passage between them (e.g., more than one doorway) so that cats can pass freely.

Daily Routine

Cats will also benefit greatly from consistent daily routines of care. They become entrained to schedules of care



FIGURE 46-40 “High five!” A trained cat offers its paw to a caregiver. Positive reinforcement-based training combines pleasant social interaction, mental stimulation, and physical activity, making it a profoundly rewarding form of enrichment. It may also enhance the cat’s appeal to adopters in a shelter setting.



FIGURE 46-41 An open-air cattery with run-style housing may be feasible in some climates. Benefits include fresh air, sunshine, and a potentially enriching environment for residents.

(e.g., feeding, cleaning, enrichment activities), and unpredictable caregiving has been shown to dramatically increase stress.¹⁴ If events that are perceived as stressful (such as cleaning time) occur on a predictable schedule, cats learn that a predictable period of calm and comfort will always occur in between. Cats also respond to positive experiences in their daily routines. For example, feeding and playtime may be greatly anticipated; thus scheduling positive daily events (e.g., a treat at 3:00 PM every day) should also be a priority.

Erratic periods of light and darkness are also known to be significant sources of stress for cats. Animals possess natural circadian rhythms and irregular or continuous patterns of light or darkness are inherently stressful. Lighting should be maintained on a regular

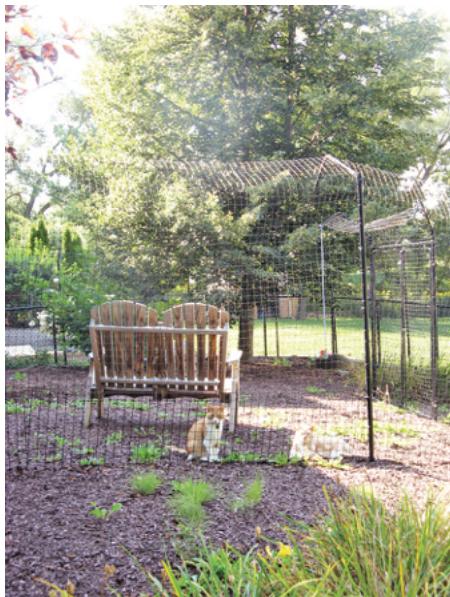


FIGURE 46-42 Purpose-designed cat fencing (Purrfect Fence, Conshohocken, Pa.) can be used to create outdoor enclosures. A mesh arc facing inward along the top of the fence prevents cats from climbing out.



FIGURE 46-43 Signs of stress may be inapparent to the casual or inexperienced observer. In this 4 × 6 ft room, nine adult cats are seen with only a single litter box. Although they may appear to be resting comfortably at a glance, a skilled observer would quickly realize that the majority are sequestered in place, while more dominant members of the colony move about, accessing colony resources and controlling the most desirable resting areas.



FIGURE 46-44 Group-housed cats in a free-ranging room. The fact that the residents are actively engaged in a variety of normal cat behaviors is evidence of a high-quality environment and a harmonious colony.

schedule, with lights on by day and off by night. Whenever possible, full-spectrum and/or natural lighting is ideal.

Monitoring

Housed cats require active daily monitoring by staff trained to recognize signs of stress and social conflict. To the inexperienced observer, such signs may appear subtle (Figure 46-43). It is often the absence of normal behaviors (such as engaging in grooming or exercise) or subtle social signals (such as covert guarding of resources or dominant staring) that signify problems. Careful observers will note these behaviors and respond accordingly to ensure that stress or conflicts do not persist. When cats are well adjusted and housing arrangements meet their behavioral needs, they display a wide variety of normal behaviors, including a good appetite and activity level, sociability, grooming, appropriate play behavior, and restful sleeping (Figure 46-44).^{44,46}

Ultimately, the success of adaptation of cats to a new environment will depend on both the quality of the environment and the adaptive capacity of the individual. Although most adapt to new environments with time, some never adjust and remain stressed indefinitely, ultimately resulting in decline of physical as well as emotional health. When cats fail to adjust to their environment and remain markedly stressed and fearful despite appropriate behavioral care, every effort must be made to prevent long-term stays. Depending on the circumstances, transfer to another colony room, foster care,

adoption, or euthanasia (when no other options exist) may be necessary to ensure cat welfare.

DEVELOPING A POPULATION WELLNESS PROGRAM: CONSIDERATIONS FOR ENVIRONMENTAL HEALTH

Achieving population wellness requires a healthy environment. Thus the clinician's final task in creating a population wellness program is to develop tailored

protocols focused on optimizing environmental conditions that favor cat health. Once again, all essential elements as noted should be addressed.

Population Density

Perhaps the most critical aspect of environmental management is to ensure a modest population density. High population density increases opportunities for introduction of infectious disease while increasing the contact rate among members of a group. Both the number of asymptomatic carriers of disease, such as those with upper respiratory infection, as well as susceptible cats in a given group are likely to increase, enhancing the odds of disease transmission among group members through both direct contact as well as fomites. In addition, crowding also increases the magnitude of many environmental stressors (e.g., noise levels, air contaminants) and compromises animal husbandry, all of which induce unnecessary stress and further inflate the risk of disease in the population. Indeed, crowding is one of the most potent stressors recognized in housed animals.⁷⁷

Although adequate space for animals is essential, it is crucial to recognize that crowding is not solely dependent on the amount of available space. It is also a function of the organization's ability to provide proper care that maintains animal health and well-being. Every organization has a limit to the number of animals for which it can provide proper care. When more animals are housed than can be properly cared for within the organization's capacity, caregivers become overwhelmed, and animal care is further compromised.^{7,54,88}

In animal shelters, crowding may also negatively impact adoption rates, because potential adopters often find crowded environments to be overwhelming and uninviting. If disease spread results as a consequence of the environmental conditions, animal adoptions may be further disrupted. Although unexpected shelter intake may occasionally result in temporary crowding, a good wellness program dictates that protocols must be in place to alleviate crowding and maintain a modestly populated environment for the health and protection of the animals and staff.⁴¹ Regardless of the setting, facilities must limit the number of animals housed to the number for which they can provide proper space and care.

There are three basic methods of reducing crowding: (1) limiting the admission (or births) of new animals into a population, (2) increasing release of animals from a population, and (3) euthanasia. In animal shelters, management practices that minimize each animal's length of stay and programs that speed or increase adoption, owner reunification, or transfer (e.g., to rescue or foster care) help to minimize crowding and maximize the number of animals that an organization can serve. It is a common misperception that housing more animals in

a shelter will result in saving more lives. To the contrary, euthanasia rates are highly correlated to intake rates, regardless of the number of animals that a facility houses. In many instances, keeping more animals in the shelter may actually reduce the organization's ability to help animals, because time and resources are tied up caring for a crowded, stressed population, rather than focusing on adoption or other positive outcomes.

In shelter medicine, the term population management is used to refer to an active process of planning, ongoing daily evaluation, and responding to changing conditions as an organization cares for multiple animals.^{7,88} The major goal of population management is to minimize the amount of time any individual animal spends confined in the shelter, while maximizing the organization's life-saving capacity. Moving animals through the system efficiently is the foundation of effective population management. To move animals through the shelter more quickly, delays in decision making and the completion of procedures (e.g., intake processing, transfer from holding to adoption areas, spay/neuter surgery) must be eliminated or minimized whenever possible. In open-admission shelters, even delays of 1 to 2 days can have a dramatic effect on the shelter's daily census, particularly for shelters handling thousands of animals per year. This, in turn, affects the ability to provide adequate care. It is important to recognize that effective population management does not change the final disposition of an animal. It does mean that determinations are made as soon as possible, which serves both the individual animal as well as the population as a whole.

Cleaning and Disinfection

For wellness programs to be effective, a clean and sanitary environment must be maintained. Not only does this promote cat and human health, but it also promotes staff pride as well as public support. In addition to protocols for routine daily cleaning and disinfection procedures, protocols should be in place for periodic deep cleaning and disinfection as well as procedures to be used in the event of disease outbreaks.

When crafting protocols, it is important to recognize that cleaning and disinfection are two separate processes. The cleaning process involves the removal of gross wastes and organic debris (including nonvisible films) through the use of detergents, degreasers, and physical action. Although this process should result in a visibly clean surface, it does not necessarily remove all of the potentially harmful infectious agents that may be present. Disinfection is the process that will destroy most of these agents, but it cannot be accomplished until surfaces have been adequately cleaned.²⁷

Disinfection is usually accomplished through the application of chemical compounds or disinfectants. The most commonly used of these are reviewed in **Box 46-9**.

BOX 46-9**Key Clinical Information Regarding Use of Common Disinfectants^{27,53,92}****Alcohol Hand Sanitizers (70% Ethanol)**

- Although commonly used, they must be applied to clean hands and allowed 20 seconds of contact time to be effective.
- They are highly effective against bacteria, but have only moderate activity against viral agents, including feline calicivirus (FCV).
- They should not be used as a substitute for hand washing or the use of gloves.

Biguanides

- Chlorhexidine is the most commonly used biguanide and is relatively expensive. Its major use is as a surgical preparation agent.
- Although biguanide compounds have broad antibacterial activity, they have limited efficacy against viruses and are ineffective against nonenveloped viruses, such as panleukopenia and FCV. Therefore they are not recommended as general-purpose environmental disinfectants.

Chlorine Compounds

- Household bleach (5.25% sodium hypochlorite) is the most commonly used chlorine compound and is an excellent, safe, and highly cost-effective disinfectant when used correctly.
- At a dilution of 1:32, bleach is highly effective against bacteria and viruses, including nonenveloped viruses, such as panleukopenia and FCV.
- Solutions must be made fresh daily and stored in opaque containers, because bleach is highly unstable once mixed with water and degrades in the presence of ultraviolet light.
- Surfaces must be thoroughly cleaned with a detergent, rinsed, and dried prior to the application of bleach, because it is ineffective in the presence of detergents and organic material.
- Proper disinfection requires 10 minutes of contact time with a bleach solution.
- Although bleach is not effective when mixed with detergents, it can be safely and effectively mixed with quaternary ammonium compounds, which do provide some cleaning activity.¹⁰¹ Therefore this combination can be used for cleaning and disinfection, provided gross organic material is first removed and adequate contact time is allowed. The addition of bleach improves the disinfection properties of the solution, making it effective against nonenveloped viruses, including panleukopenia and FCV.¹⁰¹
- Concentrations stronger than a 1:32 dilution can result in respiratory irritation for both animals and people, as well as increased facility corrosion, and are therefore not recommended for routine use.

- At a dilution of 1:10, bleach will destroy dermatophyte spores. However, cats must be removed from the environment prior to application of this concentration.
- The use of calcium hypochlorite (Wysiwash, St. Cloud, Fla.) is becoming more common and offers the potential advantages of reduced contact time and a neutral pH, which prevents corrosion.¹⁰⁸

Oxidizing Agents

- Potassium peroxyomonosulfate (Trifectant; Vétoquinol, Buena, NJ) is a commonly used oxidizing agent. A 1% solution is reliably bactericidal and virucidal (including nonenveloped viruses).
- Despite label claims, independent studies have demonstrated that potassium peroxyomonosulfate does not effectively inactivate dermatophyte spores.⁸³
- Trifectant contains a detergent; therefore it can be used as the primary agent for both cleaning and disinfection. However, periodic use of a degreaser will be necessary to remove ground-in dirt and buildup of organic debris.
- Trifectant retains activity in the presence of small amounts of organic material, making it ideal for use on porous surfaces, such as concrete and laminate. Once mixed, the solution is stable for 7 days. A 10-minute contact time is required to ensure complete disinfection.

Quaternary Ammonium Compounds

- Numerous products containing quaternary ammonium compounds are available, many of which contain detergents. At appropriate dilutions, as recommended by the manufacturer of a specific product, these compounds have activity against both bacteria and viruses; however, they do not reliably inactivate panleukopenia or FCV, despite label claims to the contrary.^{31,34,56}
- A 10-minute contact time in the absence of organic material is required for proper disinfection.
- Although quaternary ammonium compounds may be safely used in cat housing areas, care should be taken to dry surfaces thoroughly before returning cats. Cats that lick quaternary ammonium compounds may develop ulcers of the tongue that can be severe.

Disinfectants Not Recommended Due to Toxicity

The use of products containing phenolic compounds (e.g., products such as Lysol [Reckitt Benckiser, Parsippany, NJ]) or pine oils (e.g., products such as Pine-Sol, The Chlorox Company, Oakland, Calif.) should not be used in areas housing cats. Exposure to these compounds can cause serious neurologic effects and liver damage.

Product selection should take into consideration the conditions present in a given environment (e.g., the type of surface and the presence of organic matter) and the compound's activity against the pathogens for which the animals are at greatest risk. The nonenveloped viruses, panleukopenia and feline calicivirus, are of particular concern. It is important to note that despite product label claims to the contrary, multiple independent studies have consistently shown that quaternary ammonium disinfectants do not reliably inactivate these important feline pathogens.^{31,34,56} In addition to selecting effective agents, ensuring adequate contact time followed by thorough drying of surfaces is essential for achieving proper disinfection.

Protocols should include detailed methods for achieving both cleaning and disinfection. When performed properly and regularly, these practices decrease both the dose and duration of exposure to infectious agents. **Box 46-10** outlines essential considerations for the development of cleaning and disinfection protocols.

Segregation of Cats

Segregation refers to the separation of animals from the main group or into subpopulations as necessary to promote health. Segregation of cats by physical and behavioral health status is essential for infectious disease control, stress reduction, and safety.⁴¹ In animal shelters, segregation may also be required to ensure compliance with animal control procedures as prescribed by state or local ordinances. Depending on the setting, consideration should be given to separating cats by gender and reproductive status (e.g., intact, neutered, in heat, pregnant, nursing), physical and behavioral health status (e.g., apparently healthy, signs of contagious disease, reactive, feral), and life stage. A variety of separate areas will be necessary, depending on the needs of the given population and the context of the setting. The wellness program should define these areas in order to optimize cat health, while providing for the necessary functions of the facility.

Depending on the setting, consideration should be given to establishing areas for quarantine, isolation, general holding, adoption, and long-term housing, as well as to tailoring these by life stage.¹⁰⁶ For example, the very young and very old typically require more specialized care than healthy juveniles and adults. Kittens less than 4 to 5 months of age are particularly susceptible to infectious disease, and extra care must be taken to heighten biosecurity and limit their exposure. In particular, geriatric cats require comfortable, quiet quarters with careful attention to stress reduction⁹¹ (e.g., the provision of a secure hiding place and a dedicated caregiver to enhance bonding and comfort). If cats are used for breeding, functional areas will be required to facilitate mating, queening, and kitten care.⁴⁵ And, as previously

discussed, behaviorally fearful, highly reactive cats and feral cats should be separated from others—the stress responses of these cats can create fear in others.⁴²

Quarantine

Quarantine involves the holding of healthy-appearing animals. It is most useful when animals enter a closed population to ensure that they are not incubating disease when they are introduced into the general population. Quarantine areas, with rigid biosecurity procedures in place, should be used to segregate healthy animals for observation. The use of such areas not only allows apparently healthy animals to be observed for developing signs of infectious disease, but it also allows time for response to vaccination in a highly biosecure environment where exposure risks are minimized.

The use of quarantine is a mainstay of effective infectious disease control programs and is intended to prevent the introduction of disease into a population. It should be used whenever it is feasible to implement effectively, such as in a laboratory setting, a private cattery, or a low-volume, limited-admission sanctuary setting. However, quarantine practices are not effective in most animal shelters, because the high volume and turnover of animals precludes proper implementation of a true quarantine where an "all in-all out" system is used.⁴¹ Instead, incoming animals are usually added to the "quarantine group" on a daily basis, effectively defeating the purpose of true quarantine and simply prolonging the animal's stay. This is especially concerning given the fact that a cat's length of stay in a shelter is a major risk factor for development of upper respiratory infection.²⁶ For this reason, the use of quarantine is not recommended in most shelter settings. Instead, high biosecurity areas are recommended for housing the most susceptible animals (e.g., kittens less than 4 to 5 months of age). On the other hand, quarantine is warranted when a serious disease is discovered in a shelter population. If healthy-appearing animals are exposed during a serious outbreak, quarantine procedures should be used to stop the movement of animals and prevent further spread of disease. If possible, temporary closure to admittance is also recommended. Quarantine may also be required in bite cases to ensure compliance with state rabies laws.⁴¹

The particular population setting will guide the clinician's determination regarding implementation and length of quarantine, if any. A 14-day quarantine is sufficient to determine that cats are not incubating many common infectious diseases, including feline panleukopenia. However, other diseases, including feline leukemia virus and dermatophytosis, can have longer incubation periods and will therefore require a longer quarantine period.^{63,82}

In breeding colonies, early weaning and quarantine have been advocated to prevent infection of kittens with feline coronavirus.¹ Pregnant queens are isolated, and

BOX 46-10**Key Considerations for Cleaning and Disinfection Protocols^{27,53,92}**

- Staff must wear personal protective equipment, as necessary, to prevent exposure to chemicals and/or pathogens.
- Thorough cleaning and disinfection of enclosures should occur between occupants and as part of periodic deep cleaning procedures.
 - Cats must be removed from enclosures during these procedures.
- “Spot cleaning” is generally sufficient for apparently healthy cats that will continue to occupy the same enclosure.
 - The cat remains in the enclosure while it is cleaned and soiled material is removed.
 - This method is often less stressful for cats (see *Figure 46-8*).
- Separate staff should clean and care for animals in areas with highly susceptible or sick animals, whenever possible.
 - At minimum, attention should be given to the order of cleaning.
 - The least contaminated areas should be cleaned before those that are the most contaminated.
 - The most vulnerable animals should be cleaned before the least vulnerable.
- Long-term residents that are housed in the same enclosure require less frequent disinfection of their enclosure, but daily cleaning remains essential.
- Protocols should always include practices to control fomite transmission.
 - Dedicated cleaning equipment should be available for each area.
 - Protective clothing should be worn to prevent cross-contamination.
 - Hand sanitation should be achieved through a combination of hand washing, hand sanitizers, and the use of gloves.
 - Protocols should include cleaning and disinfection of all equipment that comes into contact with cats and that cannot be discarded after use.
 - Scratched and porous surfaces are difficult to impossible to completely disinfect and should be used with caution or discarded (e.g., litter boxes, carriers, or bowls made of plastic).
- Equipment known to be contaminated by virulent or resistant pathogens (e.g., parvoviruses, ringworm) and that cannot be completely disinfected should be discarded.
- Protocols should include instructions for cleaning and disinfection of the following:
 - Transport cages and vehicles
 - Commonly touched surfaces (e.g., door knobs, cage handles, light switches)
 - Food and water bowls
 - Litter scoops
 - Buckets, squeegees, and other cleaning implements
- Vacuuming (with high-efficiency particulate air [HEPA] filtration) should be used whenever possible, to minimize airborne particles and dust.
- Mops should always be rinsed to remove organic debris before being returned to a bucket of disinfectant.
- Laundry/bedding should be discarded if heavily soiled; otherwise, it should be washed in hot water and thoroughly dried in a commercial washer and dryer.
- Periodic deep cleaning should be performed on a regularly scheduled basis (e.g., weekly, monthly, or quarterly, depending on the setting).
 - Cats must be removed for deep cleaning.
 - All disposable items in the room should be discarded.
 - Cages or enclosures should be removed or pulled out from the walls.
 - Thorough vacuuming should be done to remove all particles, dander, and hair present in the environment.
 - A degreaser should be used to remove organic buildup.
 - After a thorough mechanical scrubbing, everything should be rinsed prior to application of a disinfectant.
 - Adequate contact time with disinfectants must be allowed (e.g., usually 10 minutes).
 - All air-exchange filters should be changed at the time of deep cleaning.
 - The area must be thoroughly dried and ventilated before returning cats.

kittens are weaned as early as possible (e.g., 4 to 5 weeks of age) and placed in strict quarantine. In this manner, as maternal antibody wanes and kittens become susceptible to the virus, exposure and infection are prevented. However, it is important to note that the level of biosecurity required for success is difficult to achieve.

Furthermore, eventual exposure and infection are highly likely because of the ubiquitous nature of coronaviruses.⁹³ In addition, because of the importance of the mother–kitten relationship to normal social and emotional development, this management practice may not always be desirable.

General Holding, Housing, Adoption, and Other Areas

In many settings, general holding areas are used for housing healthy juvenile and adult cats at intake. In animal shelters, it is important to consider that length of stay is associated with an increased risk of feline upper respiratory disease and that vaccination against core diseases often rapidly confers immunity. For these reasons, holding periods should be minimized whenever possible. In some cases, holding times will be influenced by legally required holding periods prescribed by state laws that allow owners a chance to reclaim lost pets. Legal holding periods are usually not required for owner-relinquished pets and preweaning-age animals, but a brief medical hold (e.g., 1 to 2 days) for evaluation and triage is usually warranted. Regardless, management practices that reduce length of stay are generally best for population health in a shelter setting.

Immunity is often strengthened with time through a combination of both active and passive immunity resulting from vaccination and exposure. Upper respiratory disease is often endemic in cat populations, and in open populations, constant introduction of large numbers of carriers and susceptible cats make exposure likely. As length of stay increases, many cats develop and recover from respiratory disease. As animals acclimate to their environment and gain immunity, less stringent biosecurity requirements may be required for long-term housing areas, depending on the particular setting. In animal shelters, the public is usually allowed to interact with cats in adoption areas, which is another management consideration.

Isolation

Isolation areas are used to segregate sick animals from the general population. Immediate isolation of animals with signs of infectious disease is critical to effective control. Isolation should be targeted by age and disease. For example, separate isolation areas should be available for cats and kittens with respiratory disease and those with gastrointestinal disease, whenever possible. In populations where upper respiratory infection is problematic, having two isolation areas for cats with respiratory infections is ideal: one area for those cats with moderate to severe signs that will require more intensive monitoring and treatment, and a separate area for those cats with only mild clinical signs and those that have been treated and are nearly recovered.⁴³ When mildly symptomatic cats can be housed separately from those that are very ill, staff compliance with isolation procedures are often improved. Cats with non-infectious conditions should also be housed in separate areas for treatment, and, in some cases, housing in the general population is appropriate.

Healthy environmental conditions in isolation areas promote recovery, and their importance cannot be overemphasized.⁴³ Crowding, noise, and stress must be avoided, and facilities must be easy to clean and disinfect. Room temperature should be warm and comfortable with good air quality. Windows are ideal, because natural sunlight is always beneficial to animal health and healing.

Biosecurity and Traffic Patterns

Strict biosecurity in quarantine and isolation areas, with attention to traffic patterns and the use of protective clothing, such as gowns and shoe covers, is essential. Footbaths are insufficient to prevent transfer of infectious agents on shoes. This is because disinfectants typically require 10 minutes of contact time and may be poorly effective in the presence of organic debris. In fact, footbaths may even contribute to the spread of disease. Dedicated boots or shoe covers should be used when entering contaminated areas.^{84,104} In addition, separate, designated staff should care for animals in high biosecurity areas whenever possible.

By design, traffic patterns should move from the healthiest and most susceptible groupings to the least susceptible, and finally to isolation areas housing sick animals. Observation windows and signage are useful to reduce traffic flow into high-risk areas. Staff hygiene is extremely important, and the importance of diligent hand washing cannot be overemphasized.

Where space or facilities are not available, foster care may represent a viable and medically sound option for quarantine or isolation in some settings. For instance, in animal shelters, foster care is particularly useful for the care of preweaning-age kittens. Foster homes must be monitored to ensure that cats receive proper care and that resident animals are protected from disease exposure.⁴¹

Other Facility Operations

In addition to ensuring proper population density, segregation, and sanitation procedures, there are several other essential aspects of facility operations that must be incorporated into a population wellness program. These include heating, ventilation, and air conditioning (HVAC) considerations, noise and pest control, general facility maintenance, and staff training.⁴¹

Heating, Ventilation, and Air Conditioning

Extremes or fluctuations in temperature and humidity, as well as poor ventilation and air quality, can compromise animal health. Poor ventilation and high humidity favor the accumulation of infectious agents, while dust and fumes may be irritating to the respiratory tract. Many cats are particularly sensitive to drafts and chilling, both of which can predispose to upper respiratory

infection. Heating, ventilation, and air conditioning (HVAC) specialists are uniquely qualified to help establish and maintain the environmental conditions required for animal health. When facilities are designed specifically for housing animals, these specialists should be consulted beforehand to ensure installation of the most effective and efficient systems possible. In reality, many facilities that house cats, including private catteries and shelters, among others, were not originally built for this purpose. Retrofitting existing facilities with the ideal HVAC system is often neither logistically nor financially feasible. Regardless, consultation with HVAC specialists is recommended in order to maximize the potential of the facility's existing system.

The recommended temperature range for cats is between 18° C and 29° C (64° F and 84° F) with a temperature setting in the low- to mid-20s Celsius (70s Fahrenheit) being typical.⁵⁴ The temperature setting should be determined according to the specific animals' needs. For example, neonatal kittens are more susceptible to hypothermia and generally require warmer temperatures than healthy adult cats. The location of the cats may also be a consideration. For example, enclosures located closer to floor level are often a few degrees cooler than those at higher levels. The exact temperature setting may also vary somewhat based on the season of the year. For instance, power companies typically recommend keeping the temperature between 25° C and 26° C (78° F and 79° F) during hot weather to conserve electricity and reduce power bills.⁴¹

Laboratory guidelines recommend 30% to 70% humidity for cats.⁵⁴ Higher humidity (e.g., 70%) may be advantageous in areas housing cats with respiratory disease because moist air may be beneficial to the respiratory passages, whereas lower humidity (e.g., 40% to 50%) may be beneficial in other areas in order to reduce survival of infectious agents in the environment. Although the range considered acceptable is large, a given room should have a relatively constant humidity (i.e., it should not have large fluctuations). Hosing or even mopping a room usually results in temporary spikes in humidity, but these will be short lived in a well-ventilated room.⁴¹

Adequate ventilation is crucial for good air quality. This is especially important for cats, because good air quality is essential for control of upper respiratory disease. Ten to fifteen air changes per hour is the standard recommendation for an animal room, but more or less airflow may be acceptable or necessary depending on the housing density.⁵⁴ Theoretically, the best case scenario, and what is typical in laboratory animal settings, is for the HVAC system to allow for 100% fresh (e.g., nonrecycled) air in each room so that the air entering a given room is exhausted out of the building and not recirculated to another room. Maintaining separate ventilation systems for various rooms or areas of a facility

prevents exchange of air among them and is recommended, because air pressure gradients that recirculate or cause exchange of air between rooms have been associated with the spread of disease by aerosols.

When applying these standard recommendations to a particular setting, there are some practical considerations that should be taken into account.⁴¹ First, even when ventilation systems provide 10 to 15 room air changes per hour, airflow may be restricted inside of cages or other enclosures within the room. In other words, the body of the room may be well ventilated, yet inside the cages, the air may remain relatively stagnant. In this case, ventilation may be improved by altering the housing design or arrangement; for example, the use of flow-through cages, runs, free-range rooms, or outdoor access may result in improved air quality. When considering the recommendations for 100% fresh, nonrecycled air with separate ventilation systems in various areas of the facility, consideration should be given to the fact that respiratory pathogens in cats are not aerosolized because of the cats' small tidal volume.³⁶ Although droplet transmission is possible, droplet spray does not extend more than 4 feet, and most transmission of respiratory disease in cats is through direct contact with infected cats, carriers, or fomites.⁵⁴ Although this recommendation seems prudent to consider, especially for isolation areas, it is very expensive to install and operate this type of ventilation system throughout a facility, especially in very cold or very hot climates. If air quality remains good and the facility maintains effective comprehensive wellness protocols, it may not be necessary for animal health.⁴¹ More research is needed on the impact of such air exchange, but in the meantime, the author recommends consulting with an HVAC specialist to establish effective and efficient settings to suit the specific needs of the given population. In addition to ensuring good ventilation, it is imperative to use other strategies for maintaining good air quality, including regular maintenance of filters, control of dust and dander through routine vacuuming and periodic deep cleaning, and the use of dust-free litter.⁵²

Noise and Pest Control

Noise control is another important consideration. It is crucial to keep cats out of auditory range of dogs, because many are profoundly stressed by the sounds of barking. Also, staff should be trained to reduce or avoid other sources of noise whenever possible. The installation of sound-proofing systems may be necessary for noise abatement and stress reduction.

Routine pest control may also be required, depending on the setting. It may be necessary to treat the environment for fleas, ticks, or other insects or ectoparasites. Products used to treat the environment must be selected carefully, because cats are extremely sensitive to the toxic effects of many insecticides.⁷⁸ In many instances, it will

be necessary to remove cats during their application and only return them to the environment once it is thoroughly dried and ventilated. If rodent control is necessary, the use of rodenticide baits should be avoided, because cats can be exposed even if the bait is not within their reach. Rodents that have ingested the poisonous bait may enter an animal enclosure and, if the animal ingests the rodent, the poison will affect that animal. Humane live traps can be used to capture rodents for removal from a facility. Food containers should be kept tightly sealed, and clutter should be minimized to discourage pests in the environment.

General Facility Maintenance

General building maintenance procedures (e.g., regular inspection and servicing with repairs as needed) are also important considerations for the maintenance of a healthy environment. For example, periodic resealing of floors may be required as well as maintenance of plumbing fixtures to repair leaks or other problems. Developing and following written standard operating procedures and daily, weekly, monthly, and quarterly checklists will ensure that systematic schedules of maintenance are carried out in a timely fashion.⁴¹

Staff Training

Regular staff training is essential for implementing effective population wellness programs. Simply stated, staff caring for animals must be qualified to do so. To a large extent, their knowledge and skill will determine the success or failure of the wellness program. Embracing a culture of training promotes high-quality animal care as well as human safety. Both formal and on-the-job training should be provided to ensure that a staff has the knowledge and skills required to perform their assigned tasks. Protocols should be established for all levels of training, and a system should be in place to ensure proficiency. Staff training should be documented, and continuing education should be provided to maintain and improve skills. Finally, training must include the provision of information about zoonoses and other occupational health and safety considerations.⁵⁴

CONCLUSION

Regardless of the setting, maintaining population health is essential for animal welfare as well as to meet the goals of the particular population. Population health depends on implementation of comprehensive wellness protocols, systematic surveillance, and excellent management. Facilities must establish goals for animal health, and wellness protocols must be regularly evaluated and revised to ensure that these goals are met. The bulk of efforts must focus on preventive strategies to

ensure both the physical and behavioral health of cats, as well as a healthy environment. A proactive, holistic approach coupled with compassion is required. When these are combined with careful attention to the unique needs and stress responses of cats, the result will be "healthy, happy cats."

References

1. Addie DD, Jarrett O: Control of feline coronavirus in breeding catteries by serotesting, isolation, and early weaning, *Feline Pract* 23:92, 1995.
2. American Heartworm Society (AHS): Guidelines for the diagnosis, treatment and prevention of heartworm (*Dirofilaria immitis*) infection in cats (2007). Available at <http://www.heartwormsociety.org/veterinary-resources/feline-guidelines.html>. Accessed June 10, 2010.
3. American Society for the Prevention of Cruelty to Animals (ASPCA): *Mission possible, comfy cats. Shelter temperament evaluations for cats*, 2003, ASPCA, p 17.
4. American Veterinary Medical Association (AVMA). Microchipping of animals (2009). Available at http://www.avma.org/reference/backgrounder/microchipping_bgnd.pdf. Accessed June 10, 2010.
5. Association of Shelter Veterinarians (ASV): Board position statement on cats who test positive for FeLV and FIV (2008). Available at <http://www.sheltervet.org/associations/4853/files/Management%20of%20Cats%20Who%20Tests%20Positive%20for%20FeLV%20and%20FIV.pdf>. Accessed June 10, 2010.
6. Association of Shelter Veterinarians (ASV): Board position statement on veterinary supervision in animal shelters (2008). Available at <http://www.sheltervet.org/associations/4853/files/Veterinary%20Supervision%20in%20Animal%20Shelters.pdf>. Accessed June 11, 2010.
7. Association of Shelter Veterinarians (ASV): Standards of care for animal shelters (2010). Available at <http://www.sheltermedicine.org>. Accessed June 14, 2011.
8. Barry KJ, Crowell-Davis SL: Gender differences in the social behavior of the neutered indoor-only domestic cat, *Appl Anim Behav Sci* 64:193, 1999.
9. Beaver BV: Fractious cats and feline aggression, *J Feline Med Surg* 6:13, 2004.
10. Bernstein PL, Strack M: A game of cat and house: spatial patterns and behavior of 14 domestic cats (*Felis catus*) in the home, *Anthrozoos* 9:25, 1996.
11. Bradshaw JWS, Hal SL: Affiliative behaviours of related and unrelated pairs of cats in catteries: a preliminary report, *Appl Anim Behav Sci* 63:251, 1999.
12. Brun A, Chappuis G, Précausta P, Terré J: Immunisation against panleukopenia: early development of immunity, *Comp Immunol Microbiol Infect Dis* 1:335, 1979.
13. Canadian Veterinary Medical Association (CVMA): A code of practice for Canadian cattery operations (2009). Available at https://canadianveterinarians.net/Documents/Resources/Files/1316_CatteryCodeEnglishFINAL%20June8'09.pdf. Accessed June 10, 2010.
14. Carlstead K, Brown JL, Strawn W: Behavioral and physiological correlates of stress in laboratory cats, *Appl Anim Behav Sci* 38:143, 1993.
15. Case LP, editor: *The cat: its behavior, nutrition and health*, ed 1, Ames, Iowa, 2003, Blackwell.
16. Cat Fanciers' Association (2010): CFA cattery standard minimum requirements. Available at <http://www.cfa.org/articles/cattery-standard.html>. Accessed June 10, 2010.

17. Centers for Disease Control: Healthy pets, healthy people. Available at http://www.cdc.gov/HEALTHYPETS/browse_by_diseases.htm. Accessed June 10, 2010.
18. Cocker FM, Newby TJ, Gaskell RM, et al: Responses of cats to nasal vaccination with a live, modified feline herpesvirus type 1, *Res Vet Sci* 41:323, 1986.
19. Coleman GT, Atwell RB: Use of fipronil to treat ear mites in cats, *Austr Vet Pract* 29:166, 1999.
20. Companion Animal Parasite Council (CAPC): General guidelines: controlling internal and external parasites in U.S. dogs and cats (2008). Available at <http://www.capcvet.org/recommendations/guidelines.html#>. Accessed June 10, 2010.
21. Counsel of Europe: Guidelines for accommodation and care of animals. Appendix A to the European Convention for the Protection of Vertebrate Animals used for experimental and other scientific purposes. Minimum cage floor area for cats. Available at <http://conventions.coe.int/sécurité/EN/123-D7.htm>. Accessed June 8, 2010.
22. Counsel of Europe: Guidelines for accommodation and care of animals. Proposed revision to Appendix A to the European Convention for the Protection of Vertebrate Animals used for experimental and other scientific purposes. Minimum cage floor area for cats. Available at <http://www.ncbi.nlm.nih.gov/bookshelf/br.fcgi?book=nap11138&part=a2000b24cddd00081#a2000b24cddd00083>. Accessed June 8, 2010.
23. Crouse MS, Atwill ER, Laguna M, et al: Soft surfaces: a factor in feline psychological well-being, *Contemp Topics in Lab Anim Med* 34:94, 1995.
24. Crowell-Davis SL: Social organization in the cat: a modern understanding, *J Feline Med Surg* 6:19, 2004.
25. Crowell-Davis SL, Barry K, Wolfe R: Social behavior and aggressive problems of cats, *Vet Clin North Am Small Anim Pract* 27:549, 1997.
26. Dinnage JD, Scarlett JM, Richards JR: Descriptive epidemiology of feline upper respiratory tract disease in an animal shelter, *J Fel Med Surg* 11:816, 2009.
27. Dvorak G, Petersen C: Sanitation and disinfection. In Miller L, Hurley KF, editors: *Infectious disease management in animal shelters*, Ames, Iowa, 2009, Blackwell, p 49.
28. Doweling JM: All together now: group-housing cats, *Animal Sheltering* Mar-April:13, 2003.
29. Dybdall K, Strasser R, Katz T: Behavioral differences between owner surrender and stray domestic cats after entering an animal shelter, *Appl Anim Behav Sci* 104:85, 2007.
30. Edinboro CH, Janowitz LK, Guptill-Yoran L, et al: A clinical trial of intranasal and subcutaneous vaccines to prevent upper respiratory infection in cats at an animal shelter, *Fel Pract* 27:7, 1999.
31. Eleraky NZ, Potgeiter LND, Kennedy M: Virucidal efficacy of four new disinfectants, *J Am Anim Hosp Assoc* 38:231, 2002.
32. Ellis SLH, Wells DL: Influence of visual stimulation on the behaviour of cats housed in a rescue shelter, *Appl Anim Behav Sci* 113:166, 2008.
33. Eisner ER: Feline dental prophylaxis and homecare, *Proc Western Vet Conf*, 2004.
34. Eterpi M, McDonnell G, Thomas V: Disinfection efficacy against parvoviruses compared with reference viruses, *J Hosp Infect* 73:64, 2009.
35. Farm Animal Welfare Council: Five Freedoms. Available at <http://www.fawc.org.uk/freedoms.htm>. Accessed June 11, 2010.
36. Gaskell RM, Dawson S, Radford A: Feline respiratory disease. In Greene CE, editor: *Infectious diseases of the dog and cat*, ed 3, Philadelphia, 2006, Saunders, p 145.
37. Gaskell RM, Povey RC: Experimental induction of feline viral rhinotracheitis in FVR-recovered cats, *Vet Record* 100:128, 1997.
38. Genchi C: Feline heartworm (*Dirofilaria immitis*) infection: a statistical elaboration of the duration of the infection and life expectancy in asymptomatic cats, *Vet Parasitol* 158:177, 2008.
39. Greene CE: Environmental factors in infectious disease. In Greene CE, editor: *Infectious diseases of the dog and cat*, ed 2, Philadelphia, 1998, Saunders, p 673.
40. Greene C: Immunoprophylaxis and immunotherapy. In Greene CE, editor: *Infectious diseases of the dog and cat*, ed 2, Philadelphia, 1998, Saunders, p 717.
41. Griffin B: Wellness. In Miller L, Hurley KF, editors: *Infectious disease management in animal shelters*, Ames, Iowa, 2009, Blackwell, p 17.
42. Griffin B: Scaredy cat or feral cat? *Animal Sheltering* Nov/Dec:57, 2009.
43. Griffin B: The lowdown on upper respiratory infections in cats, *Animal Sheltering* Jul/Aug:53, 2009.
44. Griffin B: Lessons on the importance of proper social housing in laboratory cats. In Griffin B: *A model of non-invasive monitoring of feline ovarian function in the domestic cat*, unpublished master's thesis, Auburn University, 2001.
45. Griffin B, Baker HJ: Domestic cats as laboratory animals. In Fox JG, editor: *Laboratory animal medicine*, San Diego, 2002, Harcourt Academic, p 459.
46. Griffin B, Hume KR: Recognition and management of stress in housed cats. In August JR, editor: *Consultations in feline internal medicine*, vol 5, Philadelphia, 2006, Saunders, p 717.
47. Griffin JFT: Stress and immunity: a unifying concept, *Vet Immunol Immunopathol* 20:263, 1989.
48. Griffith CA, Steigerwald ES, Buffington T: Effects of a synthetic facial pheromone on behavior of cats, *J Am Vet Med Assoc* 217:1154, 2000.
49. Hand MS, Novotny BJ, editors: *Small animal clinical nutrition*, ed 4, Topeka, Kans, 2002, Mark Morris Institute.
50. Hawthorne AJ, Loveridge GG, Horrocks LJ: Housing design and husbandry management to minimize transmission of disease in multi-cat facilities, *Proc Waltham Symposium Feline Infect Dis*, 1995, p 97.
51. Hurley KF: Implementing a population health plan in an animal shelter: goal setting, data collection and monitoring, and policy development. In Miller L, Zawistowski S, editors: *Shelter medicine for veterinarians and staff*, Ames, Iowa, 2004, Blackwell, p 211.
52. Hurley KF: Feline infectious disease control in shelters, *Vet Clin Small Anim* 35:21, 2005.
53. Hurley KF: Information sheet: cleaning and disinfection in shelters. Available at http://www.sheltermedicine.com/portal/is_cleaning.shtml. Accessed June 10, 2010.
54. Institute of Laboratory Animal Research, Commission on Life Sciences, National Research Council: *Guide for care and use of laboratory animals*, Washington, DC, 2006, National Academies Press.
55. Johnston SD: Questions and answers on the effects of surgically neutering dogs and cats, *J Am Vet Med Assoc* 198:1206, 1991.
56. Kennedy MA, Mellon VS, Caldwell G, et al: Virucidal efficacy of the newer quaternary ammonium compounds, *J Am Anim Hosp Assoc* 31:254, 1995.
57. Kessler MR, Turner DC: Stress and adaptation of cats (*Felis silvestris catus*) housed singly, in pairs, and in groups in boarding catteries, *Anim Welf* 6:243, 1997.
58. Kessler MR, Turner DC: Effects of density and cage size on stress in domestic cats (*Felis silvestris catus*) housed in animal shelters and boarding catteries, *Anim Welf* 8:259, 1999.
59. Kessler MR, Turner DC: Socialization and stress in cats (*Felis silvestris catus*) housed singly and in groups in animal shelters, *Anim Welf* 8:15, 1999.

60. Key D, editor: *Cattery design: the essential guide to creating your perfect cattery*, Cambridge, UK, 2006, Cambridge University Press.
61. Levine E, Perry P, Scarlett J, Houpt KA: Intercat aggression in households following the introduction of a new cat, *Appl Anim Behav Sci* 90:325, 2005.
62. Levy JK: Feline leukemia virus and feline immunodeficiency virus. In Miller L, Hurley KF, editors: *Infectious disease management in animal shelters*, Ames, Iowa, 2009, Blackwell, p 307.
63. Levy JK, Crawford C, Hartman K: American Association of Feline Practitioners feline retrovirus management guidelines, *J Fel Med Surg* 10:300, 2008.
64. Lindell EM, Erb HN, Houpt KA: Intercat aggression: a retrospective study examining types of aggression, sexes of fighting pairs and effectiveness of treatment, *Appl Anim Behav Sci* 55:153, 1997.
65. Lord LK, Griffin B, Levy JK, et al: Evaluation of collars and microchips for visual and permanent identification of pet cats, *J Am Vet Med Assoc* 237:387, 2010.
66. Lord LK, Ingwersen W, Gray JL, et al: Characterization of animal with microchips entering shelters, *J Am Vet Med Assoc* 235:160, 2009.
67. Lord LK, Pennell ML, Ingwersen W, et al: In vitro sensitivity of commercial scanners to microchips of various frequencies, *J Am Vet Med Assoc* 233:1723, 2008.
68. Lord LK, Pennell ML, Ingwersen W, et al: Sensitivity of commercial scanners to microchips of various frequencies implanted in dogs and cats, *J Am Vet Med Assoc* 233:1729, 2008.
69. Lord LK, Wittum TE, Ferketich AK, et al: Search and identification methods that owners use to find a lost cat, *J Am Vet Med Assoc* 230:217, 2007.
70. Loveridge GG: Provision of environmentally enriched housing for cats, *Animal Technol* 45:69, 1994.
71. Loveridge GG, Horrocks LJ, Hawthorne AJ: Environmentally enriched housing for cats when singly housed, *Anim Welf* 4:135, 1995.
72. Marretta SM: Managing oral health in breeding catteries. In August JR, editor: *Consultations in feline internal medicine*, ed 3, Philadelphia, 1997, Saunders, p 647.
73. McCobb EC, Patronek GJ, Marder A, et al: Assessment of stress levels among cats in four shelters, *J Am Vet Med Assoc* 226:548, 2005.
74. McCune S: Enriching the environment of the laboratory cat (1995). Available at <http://www.nal.usda.gov/awic/pubs/enrich/labcat.htm>. Accessed June 7, 2010.
75. McCune S: The impact of paternity and early socialisation on the development of cats' behaviour to people and novel objects, *Appl Anim Behav Sci* 45:109, 1995.
76. McMillan FD: Quality of life in animals, *J Am Vet Med Assoc* 216:1904, 2000.
77. McMillan FD: Development of a mental wellness program for animals, *J Am Vet Med Assoc* 220:965, 2002.
78. Merola V, Dunayer E: Toxicology brief: the 10 most common toxicoses in cats, *Vet Med* June:339, 2006.
79. Miller J: The domestic cat. Perspective on the nature and diversity of cats, *J Am Vet Med Assoc* 208:498, 1996.
80. Merriam-Webster's Online Dictionary 2010: Definition of wellness. Available at <http://www.merriam-webster.com/dictionary/wellness>. Accessed May 24, 2010.
81. Monte M De, Pape G Le: Behavioral effects of cage enrichment in single-caged adult cats, *Anim Welf* 6:53, 1997.
82. Moriello KA: Treatment of dermatophytosis in dogs and cats: review of published studies, *Vet Dermatol* 15:99, 2004.
83. Moriello KA, Deboer DJ, Volk LM, et al: Development of an in vitro, isolated, infected spore testing model for disinfectant testing of *Microsporum canis* isolates, *Vet Dermatol* 15:175, 2004.
84. Morley PS, Morris SN, Hyatt DR, et al: Evaluation of the efficacy of disinfectant footbaths as used in veterinary hospitals, *J Am Vet Med Assoc* 205:226:2053.
85. National Association of State Public Health Veterinarians, CDC: Compendium of animal rabies prevention and control, 2008: National Association of State Public Health Veterinarians, Inc, (NASPHV), *MMWR Recomm Rep* 57(RR-2):1, 2008.
86. National Council on Pet Population Study and Policy: The shelter statistics survey (1994). Available at <http://www.petpopulation.org/statsurvey.html>. Accessed June 8, 2010.
87. New Zealand Ministry of Agriculture: Animal Welfare Advisory Committee: Companion cats code of welfare 2007. Available at <http://www.biosecurity.govt.nz/animal-welfare/codes/companion-cats>. Accessed June 14, 2010.
88. Newbury SP: Five key population management factors affecting shelter animal health, *Proc Western States Vet Conf*, 2009.
89. Ottway DS, Hawkins DM: Cat housing in rescue shelters: a welfare comparison between communal and discrete—unit housing, *Anim Welf* 173, 2003.
90. Overall KL: Recognizing and managing problem behavior in breeding catteries. In August JR, editor: *Consultations in feline internal medicine*, ed 3, Philadelphia, 1997, Saunders.
91. Patronek GJ, Sperry E: Quality of life in long-term confinement. In August JR, editor: *Consultations in feline internal medicine*, ed 3, Philadelphia, 1997, Saunders, p 621.
92. Petersen CA, Dvorak G, Spickler AR, editors: *Maddie's infection control manual for animal shelters*, Ames, Iowa, 2008, Iowa State University, Center for Food Security and Public Health.
93. Pedersen NC: A review of feline infectious peritonitis virus, 1963-2008, *J Fel Med Surg* 11:225, 2009.
94. Povey RC, Johnson RH: Observations on the epidemiology and control of viral respiratory disease in cats, *J Small Anim Pract* 11:485, 1970.
95. Reeve CL, Spitzmueller C, Rogelberg SG, et al: Employee reactions and adjustment to euthanasia related work: identifying turning points through retrospective narratives, *J Appl Anim Welf Sci* 7:1, 2004.
96. Richards JR, Elston TH, Ford RB, et al: The 2006 AAFP Feline Vaccine Advisory Panel report, *J Am Vet Med Assoc* 229:1405, 2006.
97. Rochlitz I, Podberscek AL, Broom DM: Welfare of cats in a quarantine cattery, *Vet Rec* 143:35, 1998.
98. Rochlitz I: Recommendations for the housing of cats in the home, in catteries and animal shelters, in laboratories and in veterinary surgeries, *J Feline Med Surg* 1:181, 1999.
99. Rochlitz I: Comfortable environmentally enriched housing for domestic cats (2000). Available at <http://www.awionline.org/www.awionline.org/pubs/cq02/Cq-cats.html>. Accessed June 10, 2010.
100. Scaramella F, Pollmeier M, Visser M, et al: Efficacy of fipronil in the treatment of feline cheyletiellosis, *Vet Parasitol* 129:333, 2005.
101. Scott FW: Virucidal disinfectants and feline viruses, *Am J Vet Res* 41:409, 1980.
102. Shepherdson DJ, Carlstead K, Mellen JD, et al: The influence of food presentation on the behavior of small cats in confined environments, *Zoo Biol* 12:203, 1993.
103. Siegfried JM, Walshaw SO: Validation of a temperament test for domestic cats, *Anthrozoos* 16:332, 2003.
104. Stockton KA, Morley PS, Hyatt DR, et al: Evaluation of the effects of footwear hygiene protocols on nonspecific bacterial contamination of floor surfaces in an equine hospital, *J Am Vet Med Assoc* 228:1068, 2006.
105. Turner DC: The human-cat relationship. In Turner DC, Bateson P, editors: *The domestic cat: the biology of its behaviour*, Cambridge, UK, 2000, Cambridge University Press.

106. Vogt AH, Rodan I, Brown M, et al: AAFP-AAHA. Feline life stage guidelines, *J Am Anim Hosp Assoc* 46:70, 2010.
107. Weiss E: *Meet your match and feline-ality adoption program*, New York, 2006, American Society for the Prevention of Cruelty to Animals.
108. Wysiwash Product Information, St Cloud, Fla. Available at: <http://www.wysiwash.com>. Accessed June 8, 2010.
109. Wojciechowska JI, Hewson CJ: Quality-of-life assessment in pet dogs, *J Am Vet Med Assoc* 226:722, 2005.