In recognition of the fact that high-volume spay-neuter programs were becoming a critical component of the efforts to address pet overpopulation and reduce euthanasia of healthy dogs and cats in animal shelters in 2006 PetSmart Charities, Inc. and the ASPCA funded a task force of the Association of Shelter Veterinarians (ASV) to explore all aspects of high-volume spay-neuter programs. The task force consisted of 22 veterinarians representing numerous specialties as well as practitioners in high-volume spay-neuter clinics. After two years of work by the task force in July 2008 the Journal of the American Veterinary Medical Association (JAVMA) published “The Association of Shelter Veterinarians veterinary medical care guidelines for spay-neuter programs.” The guidelines were developed to be appropriate and achievable in all high-volume spay-neuter models: stationary clinics, mobile clinics, mash-style operations, shelter programs, feral cat programs, in clinic clinics and programs at veterinary colleges. The intent was to ensure a level of consistency, acceptability and professional in all high-volume spay-neuter programs. The guidelines included recommendations for preoperative, surgical, anesthetic and postoperative practices and were based on: accepted principles of anesthesiology, critical care medicine, microbiology and surgery; extensive review of the scientific literature; and expert opinions.

2016 guidelines
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With anticipated publication in the summer of 2016 the revised guidelines again are designed to be appropriate and achievable in all models of high-volume spay-neuter programs. In addition to sections addressing the most current knowledge related to preoperative, surgical, anesthetic and postoperative care the document has been expanded to include sections on patient care and clinical procedures as well as on operations management.

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Authors note: The 2016 ASV Veterinary Medical Care Guidelines for Spay-Neuter Programs has been submitted for publication. Accordingly, specific content of the anticipated publication cannot be published in these conference proceedings.
Most veterinary schools teach students how to perform spays and neuters at a point in their education when they are very inexperienced surgeons. Students are taught techniques that are designed to compensate for lack of anatomical knowledge, inexperience and poor surgical skills. Students are taught to double ligate everything because instructors don’t trust their ligatures. Students are taught interrupted patterns because instructors don’t trust their knots. They are taught long incisions and extensive exposure because instructors recognize that students don’t fully understand abdominal anatomy. The techniques taught are safeguards to protect patients from students at that level of their education. However, as veterinarians gain experience in surgery they become much more competent and comfortable, but often fail to abandon those techniques that were simply designed to compensate for lack of experience? Many of those techniques can be replaced by ones that are much more efficient.

Patient positioning

When performing a spay where does the surgeon stand? What factors influence where you stand during a spay? Do you stand with the patient’s head to your right or to your left? Most right-handed veterinarians stand with the patient’s head to their left and most left-handed veterinarians stand with the patient’s head to their right. But why is this? Try standing with the patient’s head to the side of your dominant hand. There is a very valid reason for this. If you strum the suspensory ligament of the ovary this allows you to strum it with your stronger hand. If you cut the suspensory ligament it allows you to cut the ligament easily with your dominant hand. While I am not recommending that you change sides of the table if you have been doing surgery for years I am recommending that you always ask why you are doing a particular technique a particular way and consider if there is a better, more efficient approach.

In a spay, position the patient with the front legs along it’s side rather than pulled forward past it’s head. Pulling the legs forward, as is commonly done, tightens the muscles of the back and tightens the suspensory ligaments of the ovaries. Positioning the limbs along side the patient’s thorax relaxes the suspensory ligaments making exteriorization of the ovaries through a small abdominal incision easier. It also helps prevent the patient from rocking side-to-side. A simple restraint devise allows this positioning of the patient and helps prevent tilting of the patient to one side or the other. An alternative, that accomplishes the same purpose is to use a V-table or V-trough without tying the front legs at all.

Surgical techniques

Minimally invasive approaches

One key to efficient ovariohysterectomies is making appropriately placed small incisions. While most surgery instructors promote long incisions and maximum exposure; lengthy incisions are considerably more time consuming to close. Small incisions, obviously, can be closed much more rapidly than long incisions. The proper location of the incision varies with species and with age of the patient. The determining factor should be which tissues are most difficult to exteriorize. In a cat spay the tissue that is more difficult to exteriorize is the uterine body. In the adult dog it is more difficult to exteriorize the ovaries. Vary the location of your incisions accordingly. Puppies are intermediate. In the cat spay the skin incision should be located on the ventral abdominal midline with the midpoint of the incision being the midpoint between the umbilicus and the anterior brim of the pubis. In the adult dog, the skin incision is on the ventral abdominal midline just caudal to the umbilicus. In the puppy spay (6 months or younger) the skin incision is on the ventral abdominal midline a little cranial to the location of the cat spay incision. The caudal-most aspect of the skin incision should be at the midpoint between the umbilicus and the anterior brim of the pubis.

In the adult dog the right kidney and the right ovary are located further cranial in the abdomen than the left kidney and left ovary. It is, therefore, more difficult to exteriorize the right ovary than the left ovary through a small incision. To equalize the difficulty of exteriorizing the two ovaries make the entry into the abdomen through a right paramedian incision. Incise the skin on the ventral abdominal midline, undermine only on the right side of the linea alba and, depending on the size of the dog, incise the rectus sheath 1/2 to 2 cm to the right of the linea alba. To prevent hemorrhage incise only the fascia. Enter the abdomen by bluntly separating the fibers of the rectus abdominis muscle and cutting the peritoneum. Castration incisions in the cat, the puppy and in the adult dog can be made through the scrotum.

Ligation techniques

Most veterinary students are taught to double ligate ovarian pedicles and uterine stumps and to ligate before transecting the tissue. It is, however, much more efficient to transect the ovarian pedicles prior to ligation and to single ligate each pedicle. In the dog the most efficient technique is to place 3 hemostats, the first most proximal on the ovarian pedicle, the second several millimeters distal to the first, but still proximal to the ovary, and the third between the ovary and the uterine horn. Close the first hemostat one click, the
second two clicks and the third three clicks. The purpose of the 1, 2, 3 clicks is to avoid completely crushing the tissue at the most proximal clamp. Completely crushing predisposes the pedicle to tearing. Before ligating, transect the ovarian pedicle just distal to the second hemostat, between the second hemostat and the ovary. Ligate with a square, surgeon’s or Miller’s knot. If you are skilled at hand ties that, too, will improve your efficiency.

**Hand ties**

Becoming skilled at hand ties; square knot, surgeon’s knot and Millers’ knots will improve efficiency in both dog and cat spays. To be efficient this skill must be practiced. But once you are skilled at hand ties they increases your speed significantly.

**Pedicle ties**

The pedicle tie is a method of ligation in which the structure is tied to itself around a hemostat. The pedicle tie can be used in cat castrations, puppy castrations and in ligating the ovarian pedicles in cat spays. There are several variations of the pedicle tie in the cat spay. In the technique I use, deliver the ovary through the abdominal incision, cut the suspensory ligament and tear a hole in the broad ligament just caudal to the ovarian vessels. Hold the ovary in your non-dominant hand and gently pull the ovary towards you. Using the dominant hand a curved hemostat is crossed over the ovarian vessels into the hole in the broad ligament and underneath and behind the vessels. The hemostat should be held closed with the tip of the hemostat facing away from you. The tip of the hemostat is then directed above the vessels as the hemostat is rotated counter-clockwise to end up facing you. The hemostat is opened and used to clamp the ovarian vessels. The vessels are cut or torn between the hemostat and the ovary and the knot is gently pushed off the tip of the hemostat. The knot should be pulled tight before releasing the hemostat. This technique cannot be used in the ligation of ovarian pedicles in dogs or puppies. Canine ovarian pedicles generally contain a significant amount of fat which interferes with making a secure knot.

**Miller’s knot**

The Miller’s knot is a very secure, self-locking knot that can be placed either with an instrument or with a hand tie. The Miller’s knot can be used on spermatic cords, on ovarian pedicles in dogs and uterine bodies of dogs and cats. To place a Miller’s knot pass the suture under the tissue to be ligated, bring the suture back over the tissue and under the tissue one more time. This creates a small loop of suture above the tissue to be ligated. Position the needle holder through that small loop, wrap the long strand once around the needle holder, grasp the short strand of suture with the needle holder and pull the needle holder towards you while pulling the long strand of suture away from you. Gentle upward tension while pulling this knot tight facilitates placement of the ligature. Complete the knot by place three or four more square knot throws.

**Scrotal castrations in adult dogs**

Scrotal castration are rarely ever taught in veterinary school, in fact, for decades veterinarians have been taught to avoid making incisions in the scrotum of dogs. Scrotal castrations appear, however, to offer several advantages over the prescrotal approach including, smaller incisions, less surgical time, and less tendecy for scrotal self-trauma. The justification for avoiding scrotal castrations in dogs had been to prevent self-mutilation, but as long as no external skin sutures are placed in the scrotum there is less risk of self-trauma in a scrotal castration than in a prescrotal castration.

Position the patient in dorsal recumbency. Grasp one testicle and position it in a manner that elevates and exposes the median raphe. Make an incision through the skin and subcutaneous tissue along or near the median raphe over the displaced testicle. Continue the incision through the spermatic fascia to exteriorize the testicle. In the closed castration technique care is taken not to incise the parietal vaginal tunic and tunica albuginea. Use gentle traction to exteriorize the testicle and reflect fat and fascia from the parietal tunic of the spermatic cord using a gauze sponge. Place three hemostats on the spermatic cord and transect the cord distal to the third hemostat. In smaller dogs (under 18 kg) a single ligature tied with a Miller’s knot and placed in the crushed area of the most proximal hemostat is sufficient for hemostasis. In larger dogs (18 kg and above) a transfixation ligature is placed in addition to and just distal to the Miller’s knot. The second testicle is exteriorized through the same scrotal incision. A second incision in spermatic fascia is made over the second testicle to allow exteriorization, transection and ligation of the second spermatic cord is accomplished in a manner identical to the first testicle.

The technique for closure is the surgeon’s preference. Incisions can be left open to heal by second intention, can be partially closed with one buried subcutaneous suture of absorbable suture material, or can be closed fully with skin glue. All three of these techniques are considered acceptable. Do not close with external skin sutures.

**Age at which surgery is performed**

As a general rule the larger the animals is (dog or cat), the more obese the animal is, and the older the animal is, the longer it will take to perform a spay or neuter surgery. Even though most of us were taught to wait until a dog or cat is sexually mature (six to nine months) before sterilization surgery there is growing evidence that there is no reason to wait until the animal is an adult. Pediatric spay neuter has been shown to have little or no adverse physiologic effects on the animal and spay/neuter in the pediatric patient is much easier and quicker than that in the sexually mature patient.
Conclusions
Becoming efficient at spays and neuters is a combination of many factors. One of which, of course, is the skill and comfort level of the surgeon. Adoption of specific techniques that are used commonly in high-volume spay neuter clinics can significantly improve surgical efficiency. Being willing to question why you were taught specific manipulations in veterinary school and recognizing that it is acceptable to abandon some of them (such as always double ligating pedicles) will improve surgical efficiency greatly.
A Happy Cat is a Healthy Cat: 
Humane Feline Housing in Animal Shelters
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It was not long ago that cats in animal shelters were housed in small, stainless steel kennels with loud, stainless steel doors in small rooms with fluorescent lighting. Often “enrichment” consisted of putting a couple of balls or some toy mice in the kennel. Kennels were completely cleaned out every day with new litter, food and water bowls, and newspaper cage liners added every day. When kennels filled with cats, new arrivals were either put into rooms together or temporary kennels were added in hallways or bathrooms. The amount of cats a shelter kept in the building at a time was determined solely by how many animals they could fit in the building. Unfortunately, this is the way cats are still cared for in many animal shelters today. Cats deserve better and a wealth of research and experience housing cats has provided us with the information we need to care for cats more humanely.

Feline housing is often not considered a high priority in shelters despite research and anecdotal evidence suggesting its tremendous impact on the behavioral and medical health of sheltered cats. Housing is an important consideration in every aspect of sheltering cats and should be considered at every step from pre-intake until final disposition. Many factors related to housing, including adequate hiding and resting spaces, segregation of species, noise suppression, separation of eating and elimination areas, floor space provided per cat, appropriately sized litter boxes, air quality, and the proper use of community cat rooms are all important to decreasing stress and improving welfare. In order to provide appropriate housing, shelters need to closely monitor their capacity for care and adequately manage intake to stay within that capacity.

Ellis et al.1 describe 5 pillars of a healthy feline environment, and while these were not directly written with sheltered cats in mind, they apply well to sheltering environments. Environmental needs include providing a safe place; providing multiple and separated environmental resources; providing opportunity for play and predatory behavior; providing positive, consistent and predictable human interaction; and providing an environment that respects the cat’s sense of smell. All of these can be accomplished in most animal shelters.

Many studies have proven the positive benefits of providing cats with a safe place that allows them to display normal hiding behavior. In 2007, Kry and Casey2 found that cats with BC SPCA Hide & Perch™ boxes had lower stress levels than controls with open beds. They also displayed relaxed behaviors more frequently than the control group. Another small study found that cats given a hiding box were able to recover from change to a new environment faster than cats that were not given a hiding box.3 Hiding boxes and perches are also important to communally housed cats, and allowing them to display hiding behaviors can increase the overall use of available space.4 Providing a safe place to cats in shelters is rather easy to accomplish. A simple cardboard box will often suffice. Many options are also commercially available, including feral cat dens that can be used throughout a cat’s stay then disinfected and reused.

There may be some benefit to providing multiple hiding or perching opportunities as a cat’s preference for specific spaces may change over time or over the course of the day. Cats that are less social or are experiencing more stress may prefer a closed space while cats that are more relaxed and more social may prefer a high perch, such as a vertical cat tree.5 Providing a place where cats feel safe also means segregating species and reducing noise. Cats should be provided space that is free of the noises and scents of their canine counterparts to every extent possible. Because noise is known to be a stressor for sheltered cats, noise reduction should be considered when designing feline housing. Simple “fixes” like buffering the sounds of kennel doors closing can provide a less stressful environment for cats without much of a financial investment. Maximal separation of eating, elimination, and resting areas (preferably with a minimal triangulated distance of 2 feet) and allowing for approximately 9 feet of floor space in individual kennels may decrease the risk of upper respiratory infections in shelters.6 Large cages can help make cats less stressed, less likely to get sick, and less likely to be euthanized.7 This is also quite important in community cat rooms where it is important to provide multiple resources that are visually and physically separated. It is also important to make sure these resources meet the needs of the cats. For example, kittens and geriatric cats may prefer low spaces because they will have difficulty reaching higher ones. Litter boxes need to be appropriately sized, and in a community cat room it may be appropriate to cover some and not others to allow cats an opportunity to choose.

Allowing animals to express normal behaviors is one of the five freedoms.8 Cats are natural predators and allowing them the opportunity to express this behavior and play behaviors is an important part of enhancing their emotional health. Simple fixes include playing with ribbons or toys with strings on the end and allowing the cat to “catch” them, using puzzle feeders, or hiding food throughout an enclosure for the cat to find. Social cats will also benefit from being in communal housing with other social cats. Excellent work has been done in the study of human interaction and feline stress in shelters. A decade ago, Gourkow and Fraser9 researched different levels of enriched housing with consistent handling compared to a control group of cats in a more typical shelter situation. They found that the cats with consistent and careful handling that had additional time with their caretakers and were in
enriched environments had higher adoption rates, lower length of stay before adoption, and less fearful behavior. This was despite two of the enriched areas being in higher stress areas (closer to dog pens and a higher traffic area.) More recently, it has been demonstrated that cats that enter a shelter content are more likely to stay content if provided with consistent daily human interaction.\textsuperscript{10} It has also been shown that cats that enter the shelter anxious may experience more contentment if gentled.\textsuperscript{11}

In shelters that are very busy with a limited staff, it may be difficult to implement a consistent schedule that allows for positive interaction with cats, but research is suggesting that it is worth the effort. Volunteer schedules would be valuable to allow for the same people to interact singly with cats on a daily basis.

Protecting air quality is important for many reasons. Air quality in shelters is often discussed as a means to lower the rates of respiratory infections in both cats and dogs. Respecting the importance of the cat’s sense of smell is also an important reason to carefully consider air quality and anything that may affect the air space in which a cat resides. While some odors may have potential use as environmental enrichment\textsuperscript{12} it is generally best to not alter the smell of a cat’s habitat whenever possible. Spot cleaning is often performed to decrease the re-housing stress a cat experiences in a shelter. There are many benefits to spot cleaning cat kennels and maintaining the scent of the cat in its kennel as well as not introducing the smells of disinfectants are two of those benefits. Other ways to protect air quality include reducing overcrowding, using unscented litter, opening windows and doors when possible, and avoiding spraying chemicals in rooms where cats are housed.

Properly utilizing community cat rooms is another important consideration. Community rooms should never be used with the sole purpose of trying to house more cats. The stress a cat experiences in a shelter has to do with their own personality, how well socialized they were as a kitten, their age and sex\textsuperscript{5}, and whether they come from a single cat or multi-cat household if relinquished.\textsuperscript{13} It is important to consider some of these factors when choosing housing and deciding between traditional cages, enriched kennels, and community rooms. It is also important to monitor cat’s behavior and health daily to ensure s/he is adjusting to the shelter well and that the best housing was chosen. Monitoring weight may be helpful also because cats with higher stress scores tend to lose weight and be more susceptible to URI.\textsuperscript{14}

When choosing cats for community housing, it is best to utilize these rooms for those slower track animals that will have longer shelter stays. Cats tend to do better in stable groups, and the constant introduction of new cats can be a source of stress as well as provide the opportunity for introduction of infectious disease. Identify which cats will likely experience the most stress (shy or poorly socialized, those that have been singleton house cats, geriatric, etc.) and assess them more carefully when considering housing. Cats chosen for community housing should be altered, free from infectious disease, free from parasites, and vaccinated. It is also not recommended to communally house kittens under 5 months old except with litter mates and to segregate kittens from 5-12 months old from those over 12 months. Separating juveniles from adults is not only ideal for prevention of infectious disease, but these cats will also have different social and play patterns than their adult counterparts.

The importance of providing adequate resources cannot be stressed enough. Food and water bowls and litter boxes as well as resting perches, hiding boxes, and toys should be in good supply to reduce any agnostic behavior. These resources need to be separated by at least 2 feet as in standard cages and need to be visually separated from other resources. It is also best for any hiding box to have two exits so one cat cannot “trap” another cat. Placing some resting and hiding areas up high and others lower will also help cats choose which they prefer as well as allow access to those with decreased mobility.

Most of these ideas can be implemented in any facility. Cat housing should be a priority when new buildings are planned, but many organizations are working in very old, outdated facilities with small cat rooms and old, stainless steel kennels as their only housing option. The most difficult part of implementing new housing for older shelters isn’t changing the housing but convincing all stakeholders that it is necessary to change. When we talk about decreasing the amount of cat kennels, people often think this means we are talking about euthanizing more cats. A paradigm shift is necessary to truly improve the welfare of cats. Teaching people that improving the welfare of cats will not only improve life for them but will also decrease length of stay, decrease infectious disease, and lower euthanasia will be an important part of this education.

Maintaining the shelter’s capacity for care is a vital component to any feline housing plan and is extremely important when ensuring humane care for all animals. A discussion of capacity for care and how to properly manage cat populations cannot be covered in this short discussion, but there are many resources available to help shelter veterinarians understand and implement plans for maintaining that capacity. A new (spring 2016) and valuable resource is the University of Wisconsin Shelter Medicine Program video series. Videos include talks on cat stress and housing, managed intake, enrichment programs, capacity for care, and other important topics. This lecture series can be found at: \url{http://videos.med.wisc.edu/uwvetmedsheltermedicine}. Other resources include: UC Davis Koret Shelter Medicine Program (\url{http://www.sheltermedicine.com}), ASPCA (\url{http://aspca.org}), and the Association of Shelter Veterinarians \textit{Guidelines for Standard of Care in Animal Shelters} (2010, Newbury et. al.), which can be freely accessed at \url{http://www.sheltervet.org}.

Many resources also exist to find solutions for older facilities to improve welfare. These solutions include things as simple as putting cardboard boxes in kennels, covering part of a kennel door to allow for privacy, building beds out of PVC pipe, and cutting
portals between kennels. Instructions and ideas for these can be found in many places online including both the Koret Shelter Medicine Program website as well as the ASPCA Professional site.

Providing humane housing for cats should not be a luxury but rather a priority for sheltering organizations.

References
The importance of record keeping and accurate data management is often underestimated in animal shelters. Timely and accurate record keeping has become increasingly important as shelter veterinarians learn to use this data to efficiently manage populations and control infectious disease. While paper records are still useful, the movement to computerized records has allowed us to quickly analyze shelter statistics to monitor trends and facilitate positive outcomes. Accurate record-keeping is also necessary to keep the community involved, to budget more efficiently, and will help when seeking funding.

The American Humane Association has some good advice when it comes to management of shelter records.¹ 1. Keep it simple to decrease errors. 2. Don’t reinvent the wheel. With so many sheltering agencies willing to share their forms, there is no need to start from scratch. 3. Identify the source of your forms by placing the agency name and logo on them as well as the phone number and website when needed. 4. Review forms regularly and ensure they still meet your needs. 5. Make your forms user friendly and accessible to the local population. In some areas having forms in different languages may be very helpful. 6. Make sure your staff understands the importance of accurate and timely record-keeping. 7. Limit access to those that need it. 8. Make sure paperwork is filed in a manner that allows for efficient retrieval. 9. Cross reference forms as needed. 10. Computerize your data. 11. Have a local attorney review all forms. 12. Use an effective storage system. 13. Avoid problems by planning ahead, paying attention to detail, training staff, allowing sufficient time to complete paperwork, and storing/filing efficiently.

Computerized records allow for data to be easily and efficiently retrieved and analyzed, but choosing a software provider can be a difficult task. Many companies have developed shelter management software, and each has its own benefits and drawbacks. A thorough software review is not possible in the confines of this lecture, but a partial list of available software is listed below. Those considering different providers should contact references in similar shelters (size, function, intake, etc.) to see how that software is working for them. I would also suggest looking not only at the software, but also at the technical assistance provided long-term, the annual costs, potential maintenance, amount of computers that can have access, if the program will fit the long-term needs of the organization, and whether or not records can be accessed remotely if needed. When considering cost, also ask if upgrades are included in initial cost, what kind of training and customer service is included, and if data return is efficient and costly should the shelter leave that provider. Choosing a software provider is an extremely important task, and one should not just consider cost when making that decision. The efficiency of the entire organization relies on efficient and accurate record-keeping so this task should not be taken lightly.

For those shelters with very limited resources and no access to computerized records, paper records can be utilized. Important data points from these records need to be put into a spreadsheet in order to effectively use the information to make management decisions. From personal experience, I have found that many shelters that believe they cannot afford the cost of computerized records have been able to find very low cost or free options when they investigated all software options available. Shelters have also been able to obtain grants to pay for the hardware necessary to use these options. I would strongly encourage any shelters that have not fully investigated the option of computerized records to do so. They do allow for much more efficient tracking and use of data.

In order to understand shelter data, we must first understand some of the commonly used definitions and calculations. In 2004, the Asilomar Accords were written as a means to find a standard way of reporting shelter statistics.² A review of this entire document is not possible in the confines of this lecture, but all shelter veterinarians and directors should have a basic understanding of the definitions contained within. For the purposes of this lecture, we need to define a few of these terms. Intake is defined as all live dogs and cats for which your shelter assumed responsibility. Adjusted total intake is the total intake minus the number of unhealthy and untreatable dogs and cats your shelter euthanized at the request of the owner or guardian. Adoption is the number of dogs and cats your shelter placed with members of the community. This does not include animals in fosters or transferred to other organizations. Return to owner (RTO) is the number of stray dogs and cats your shelter reunited with their owners. Euthanized is the number of dogs and cats your shelter euthanized. These are often broken down into four categories: healthy, treatable-rehabilitatible, treatable-manageable, and unhealthy-untreatable. Total euthanasia is the total amount of dogs and cats your shelter euthanized. Adjusted Total Euthanasia is the total euthanasia minus the number of dogs and cats that were unhealthy and untreatable. Died or lost in shelter care are those dogs and cats that could not be accounted for or died while in the shelter’s care (but were not euthanized). This includes those animals that died in foster or in transit. A shelter’s annual live release rate is calculated as adoptions + all outgoing transfers + return to owner divided by total outcomes excluding owner requested euthanasia (unhealthy and untreated only) and dogs and cats that died or were lost in care. When publishing live release rates, organizations should include a statement that includes the number of owner requested euthanasia that were unhealthy and untreatable as well as the number of dogs and cats that died or were lost in shelter care.
When monitoring trends in live release and euthanasia, it should be noted that these numbers should be looked at for trends in an individual shelter but not compared among shelters. The progress of one shelter may also not be indicative of the progress of a community as a whole. For example, some shelters take in far more animals that are seized and euthanized to protect public safety than others. It is not fair to compare an animal control facility in a metropolitan area that may take in many critical trauma cases as well as a fair number of abuse and bite cases to a limited admission facility in a less populated area.

While much focus is placed on live release and euthanasia rates, many other calculations are vital to monitoring and maintaining the health and management of your shelter. These include infectious disease rates, physical holding capacity, adoption driven capacity, staff capacity for daily care, length of stay, and unassisted death rates. In some cases, the numbers can be used as a tool to evaluate the effective management of a facility. For example, increases in infectious disease, unassisted deaths, or length of stay could indicate a breakdown in shelter management.

Tracking of infectious disease is important to monitor the health of the animals and the facility management. If done properly, the collected data could be used for monitoring the frequency of disease as well as the risk factors (age, housing type, zip code of intake, etc.) One study suggested tracking the health status at intake and outcome, vaccination status, and age of cats would be beneficial in monitoring the frequency and risk factors for feline upper respiratory infection. Monitoring rates of viral diseases such as canine parvovirus could help detect outbreaks rapidly and allow for immediate implementation of outbreak management plans which could mitigate the damage caused by these diseases. Monitoring these trends over time could help managers and veterinarians detect slow increases in disease rates that could point to problems with staff adherence to established protocols. Without data, these trends may go unnoticed until a large outbreak occurs.

Recognizing a shelter’s capacity is a challenge for nearly all shelters. When organizations allow themselves to go over their capacity for care, many problems occur including a loss in animal welfare and an increased risk of compassion fatigue and staff burnout. An overall discussion of capacity for care is not feasible in this short discussion, but the reader is encouraged to use the resources listed below to seek further information. Defining a shelter’s physical holding capacity is a bit easier to understand. The physical holding capacity is the physical space required to hold animals not currently available to go home with adopters. The adoption driven capacity is the optimal number of animals a shelter should have available for adoption or moving towards adoption in those shelters that utilize open selection. While many shelters base this number solely on the number of kennels they have in adoption, it is advisable to base this number of the number of adoptions and desired length of stay. The staff capacity for daily care is the number of animals that can be adequately cared for on a daily basis. All of these figures are explained in much greater detail on the information sheet titled Calculating Shelter Capacity, which can be found at: http://www.sheltermedicine.com/library/calculating-shelter-capacity.

The importance of length of stay (LOS) cannot be overemphasized. Tracking this important data point for entire stays as well as stays in certain areas of the shelter can help organizations find and correct bottlenecks and other barriers to efficient flow through the shelter. Increased LOS has been associated with increased risk of illness and can lead to increased behavioral concerns. Keeping animals in the shelter longer also increases costs associated with caring for those animals and decreases the number of animals that can move through a shelter. Because LOS has broad-reaching impact, it is vital that shelters track this statistic and work to find the optimal LOS for their organization and the animals in their care. In general, the LOS is the number of days an animal is in the shelter’s care from the time of intake until the time of disposition. An average LOS can be found by dividing total care days by the number of animals in the shelters care or by averaging the LOS of all animals. Some computer software will calculate this number and can provide LOS data by species, age, stage in care, and many other variables. In general, a shelter’s necessary daily capacity will equal the daily intake multiplied by the average LOS.

Unassisted death (those that died in the shelter’s care but were not euthanized) should also be tracked. While some deaths in care may be unavoidable, increases in these numbers are alarming and could be a sign of a serious breakdown in care. If a shelter starts a foster program and thus sees a substantial increase in care of neonatal kittens, there may be an expected increase in unassisted death. But if this rate goes up without a significant management change that would cause an expected increase, the deaths should be thoroughly investigated to find the underlying cause. Surgical deaths are included in this number, and a sudden increase in surgical or anesthetic deaths would be just as alarming as a sudden increase in death due to disease.

Other examples of data that can be useful if monitored include the number of animals returned to the shelter after adoption, owner relinquishment statistics, animal statistics by intake area, and adoption numbers by site. If higher numbers of animals are being returned to the shelter after adoption, it may indicate a review of adoption procedures or behavioral management. Owner relinquishment statistics can help in many ways. Tracking cause of release can help identify diversion programs that may be useful such as food pantries or behavioral assistance. Tracking intake area for owner releases can help target areas that may need outreach resources such as low cost veterinary clinics or spay/neuter resources. Stray intake area can be similarly monitored and may help target trap-neuter-release efforts. Monitoring health of stray intake by area may identify areas that should be the focus of vaccination clinics. Adoption numbers by site is important for those facilities with more than one structure or that utilize off-site adoptions.
While total adoption numbers are important, it is also helpful to know how many adoptions are happening at each specific site in order to better manage the population.

Data relating to surgery programs is also important. Monitoring the amount of surgeries done by type can help plan for periods when veterinarians may be very busy and need additional support. These numbers are also useful when planning medical budgets and applying for grants specific to spay/neuter. Morbidity and mortality reports are extremely important and should be monitored closely by the attending veterinarian. Any increase in surgical or anesthetic complication rates should be thoroughly investigated to identify cause. If shelters out-source surgical procedures, data should be kept on complications separately for each veterinary clinic utilized for this service. If an increase in complications is seen from a specific clinic, the attending veterinarian will need to be notified.

Data is important not only to individual shelters but also on a national scale. Compiling data from multiple shelters allows us to see trends that may not show up in the individual shelter. More importantly, it can demonstrate what is working on a larger scale and give us the view of the big picture. Shelter Animals Count is a new national database project with nearly 4000 participating shelters. Participating shelters provide monthly summary data that includes information on dogs and cats broken down by age category. The database provides specific definitions for each category of data it collects which eliminates ambiguity and ensures consistent data among shelters. Any organization that is involved in animal adoptions or transfers and has intake and outcome data is encouraged to contribute. This collaborative effort with representatives from multiple animal welfare agencies was designed as a lifesaving tool to be used on a local and national level.

It is not uncommon to find shelter workers that think they do not have the time to track data or do not see a need for managing this information. Veterinarians and directors need to recognize the vital importance of statistics to managing their shelter populations and keeping animals healthy. The importance of this information needs to be passed down to the staff members charged with inputting information, and they need to be trained appropriately so accurate information is obtained.

Examples of Available Shelter Software (This is only a partial list and does not in any way reflect an endorsement of any of these products):

- ARK Shelter Software http://www.arksoftware.com/
- PetPoint™ Shelter Data Management System http://www.petpoint.com/
- Shelter Pro Record Management Software http://shelterpro.com/
- Shelter Buddy Software www.shelterbuddy.com
- HLP, Inc./Chameleon© Software Products http://chameleonbeach.com/

Capacity for Care Resources (This is a partial list, and the reader is encouraged to investigate further if they would like more information):

- University of Wisconsin Shelter Medicine Program video series (http://videos.med.wisc.edu/uwvetmed/sheltermedicine)
- UC Davis Koret Shelter Medicine Program (http://www.sheltermedicine.com)
- ASPCA (http://aspcapro.org)

References

Don’t Throw the Baby Out with the Bathwater:
How to Manage a Parovirus Outbreak without Euthanizing
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With more and more emphasis being placed on live release rates and improving the health and welfare of sheltered animals, shelter veterinarians are starting to look at problems we once thought unsolvable and developing ways to solve them. One of those problems is often thought of as a bad word in sheltering: parvo. We speak it under our breaths and dread the day it rears its ugly head in our shelters. Not only are puppies with parvo often euthanized, so are their littermates and sometimes every animal in the shelter at the time of diagnosis. We used to think of this as an acceptable way to manage the disease and mitigate the damage it could do. Depopulation followed by a thorough decontamination would prevent spread until it showed up again in another population. Fortunately, things have changed. We know a lot more about outbreak response and controlling the spread of disease. We have inexpensive, in-house means to not only diagnose effectively but also to determine disease risk in our population. This allows us to plan quarantine periods and allow animals not at risk to move out of the shelter. In recent years, we’ve also learned that parvo can be effectively and inexpensively treated in the shelter so that fewer animals require euthanasia. The outlook has definitely improved for shelters and the dogs in their care.

As with any illness, prevention should be our first goal. Since it has been shown that many animals enter the shelter naïve to parovirus\(^1\), vaccination and segregation of populations should be at the forefront of any prevention strategy. Intake protocols and daily medical rounds must focus on identifying, isolating, and testing those animals with clinical signs as soon as they appear. Proper housing decisions and thorough disinfection with parvoviral disinfectants will help prevent outbreaks of disease. Good prevention strategies will prevent a lot of pain and suffering for your animals as well as your staff.

In-house testing methods are fairly straightforward and relatively inexpensive. In house fecal antigen test kits such as the SNAP Parvo Antigen Test from IDEXX are an excellent first step in diagnosis, but they should not be relied upon exclusively. False negatives can occur even in the symptomatic animal due to the relatively short viral shedding period, antigen-antibody binding, and other factors. False positives can also occur, and it is recommended that all results be interpreted with the history and clinical signs in mind. A stained blood smear should also be evaluated before a definitive diagnosis can be made\(^2\). In-house serology is also available, relatively inexpensive, and has been found to be accurate and useful in shelter population management decisions.\(^3,4\) Serology can help differentiate those animals that are at risk from those that are very low risk, which allows for more efficient movement of animals and improved response to disease outbreaks. Effectively and efficiently diagnosing those that are ill and segregating those that are not at risk from those that require quarantine allows us to keep animals moving and focus our efforts on caring for those that need the most attention.

The decision to treat dogs with parvo is not a decision that can be made lightly. As is sometimes the case in sheltering, wanting to help a few can cause harm for many. Ensuring treated animals are receiving prompt and proper care while also making sure no other animals are being exposed is of utmost importance. This will require the close supervision of a veterinarian, diagnostic equipment, financial resources, and the staff and facilities to run an isolation ward. Staff or volunteers will also need to be available to socialize puppies and provide behavioral management for any adults. Adoption capacity should also be considered. If homes cannot be found for the animals after treatment, serious consideration should be given to whether or not it is appropriate to expend the resources on treatment. In shelters where healthy dogs and puppies are being euthanized for lack of adoptive homes, it may not make sense to treat infected dogs. The risk of puppies shedding virus for 10-14 days after recovery must also be considered, as it may not be ideal to place them immediately into adoption rooms post-treatment.\(^5\)

Before attempting to treat any dogs, a proper isolation ward must be set up with available staff and a medical protocol must be written. It is best to have the isolation ward in a building separate from where other dogs are housed, but an area of the same structure can be used as long as very careful attention is paid to preventing cross contamination. Shelters that have been successful at treating parvo in-house use gowns and foot covers and have a “once in-never out” policy for anything inanimate that goes into their parvo wards. This ward should have its own medical, cleaning, grooming, and general care supplies. The staff that work in this ward need to be separate from the staff that care for the shelter’s other animals, and the importance of socialization in the critical early months cannot be forgotten with puppies being treated. Because most shelters lack the resources to provide extra staffing, this is often done via volunteer scheduling with a staff member supervising.

The basic steps for treating cases of parovirus include deciding if treatment is right for that dog, correcting dehydration, ensuring adequate nutrition, preventing secondary bacterial infection, and alleviating discomfort. The medical protocol should include a plan for deciding if treatment is right for any particular puppy or dog. This protocol should be one with a little “wiggle room” for medical judgement, however. The decision to treat or euthanize should be made only by a veterinarian and will depend largely on how far advanced the disease is upon diagnosis, the dog’s overall health, the dog’s behavior.
and adoptability post-treatment, and the shelter’s resources to properly care for the dog among other factors. At the start of any treatment program, the veterinarian may elect to treat only those cases that have a very good prognosis and will likely require less advanced care. This will allow the shelter to try the program, make sure everything is running smoothly, and practice using their new medical and infection control protocols with less stress. Good outcomes in the beginning of the program will also build trust and foster good relationships with volunteers and the general public.

Correcting dehydration is a vital part of treatment but can be difficult in a shelter setting. While IV fluids are the gold standard, the risk of catheter infection is high, and staff is not always available to closely monitor the fluid lines and replace catheters as needed. For those patients that are not severely dehydrated, subcutaneous fluids are an acceptable alternative. It should be noted, however, that subcutaneous fluids also pose a risk of infection in the immunocompromised patient so great care should be taken to ensure injection sites are clean. Measuring dehydration levels subjectively is straightforward and can be accomplished by most staff members with proper training. Dogs with 10-12% dehydration will have very dry mucous membranes, a loss of skin turgor, sunken eyes, and may be showing signs of shock. Dogs that are 6-8% dehydrated will often have delayed skin turgor, a slight increase in capillary refill time, and their eyes may be slightly sunken. Patients with 5% dehydration will often only have a slight loss in skin elasticity. If available, urine specific gravity can be helpful in determining hydration status. A packed cell volume and total plasma protein is less helpful in measuring dehydration in patients with parvo due to effects of blood loss on these results. Correcting dehydration involves estimating the fluid loss that has already occurred as well as accounting for future losses and maintenance requirements. Fluid volume to be replaced can be calculated with the following formula: % dehydration X body weight in kg = L of fluid to replace. Ongoing losses equate to approximately 15 ml/kg/day in addition to the fluid lost through vomiting and diarrhea. It is important to remember that anorexia can lead to potassium loss and hypoglycemia. The potassium loss can be compounded by diarrhea and diuresis as fluid replacement occurs, and hypoglycemia may be more profound for those puppies and smaller breed dogs with lower glycogen stores. Potassium and glucose levels should be monitored and supplemented with fluid therapy additives or orally as needed. Protein loss will also occur through the GI tract so protein levels also need to be monitored. Once dehydration has been corrected, hypoproteinemias can be corrected with administration of whole blood, plasma, or synthetic colloids.

Ensuring adequate nutrition is an important part of treatment, and a plan should be in place to maintain proper nutrition. Early enteral nutrition can promote earlier clinical improvement and help with weight gain during treatment. This can be accomplished by placing a nasogastric feeding tube, but in a shelter situation it is often more realistic to provide small amounts of canned food mixed with water multiple times daily and syringe feed if the dog is anorexic.

A prominent feature of parvovirus is a significant leukopenia that lowers the animal’s immune response. The virus also blunts the intestinal villi, further increasing the risk of enteric bacterial proliferation. This combination of events sets the patient up for secondary bacterial infections and, if untreated, can lead to sepsis and death in many puppies. To prevent this sequela, the veterinarian must choose an antibiotic therapy with broad spectrum coverage against anaerobic pathogens. Often this means a combination of drugs must be used. Antibiotic therapy should be determined on an individual basis by the attending veterinarian. During treatment, it is important to remember that there is a lot of discomfort associated with severe enteritis, nausea, and vomiting. While NSAIDS are not ideal in the dehydrated patient, other pain control options exist. For those animals whose emesis cannot be controlled, CRI with low doses of ketamine will make them more comfortable. CRI is labor-intensive and often too expensive in animal shelters so often opioids or similar compounds are given orally or injected to control pain during treatment. Antiemetics are beneficial for many reasons, one of which is to decrease pain and discomfort. Options include metoclopramide, serotonin inhibitors, or maropitant. Parasite prevention should not be forgotten in the course of treatment. If dogs have not been previously treated for parasites, they should be treated as soon as possible. The severity of disease can be worsened by concurrent parasite infestation. If oral medications cannot be given due to vomiting, injectable medications such as ivermectin can be used. Veterinarians must also not forget the importance of daily abdominal palpation to check for intussusception. Another important thing to remember is that very young puppies can present with cardiac symptoms related to parvovirus rather than the usual gastrointestinal signs. And finally, protocols should also address the fact that cats and dogs should not be housed together or have contact in the shelter. This is for many reasons, one of which is that cats can be asymptomatic carriers of canine parvo virus.

Upon resolution of clinical signs, dogs can still shed virus in the feces for approximately two weeks. Care must be taken during this time to provide for socialization without risking infection for the population. One approach to handling this issue is to adopt the puppies to families that do not have naïve dogs at home and educate them concerning the potential for spreading the virus. It is also low risk to move the dogs to adoption after recovery if a fecal antigen test is negative. These dogs should still be housed separately from naïve populations. It is very important to bathe animals well, paying careful attention to nail beds and foot pads, before allowing them to leave isolation. This is done to mechanically remove any feces or virus persisting on the animal. Following treatment, puppies should be returned to their normal revaccination and deworming protocol schedules.

Questions often arise concerning the use of interferon omega, human granulocyte colony stimulating factor, and oseltamivir for the treatment of parvo virus. Interferon omega does have some promise in parvo treatment because it has been shown to improve clinical
thought impossible. It is not available in the United States at this time, however. Studies have demonstrated that the use of rhG-CSF is not useful for the treatment of canine parvovirus. The use of oseltamivir is still speculative, and is not recommended.

In a study completed at Colorado State University, they were able to achieve similar success with an outpatient protocol as they were with an inpatient protocol. The outpatient protocol is much less expensive and easier to manage in shelter populations and has thus been utilized in many shelters since. The basis of the protocol is administration of SQ fluid therapy as well as cefazolin and maropitant. A more detailed protocol can be found online at: http://csu-cvmbs.colostate.edu/documents/parvo-outpatient-protocol-faq-companion-animal-studies.pdf.

One example of a very successful parvo treatment program is Austin Pets Alive! In Austin, Texas. By effectively preventing cross-contamination and providing care and treatment to puppies with parvo, they have been able to pull more than 1800 dogs that would have otherwise been euthanized. Their parvo puppy ICU has treatment success rate of 90% (A. Bardzinski, personal communication 3Aug2016). Their subcutaneous protocol for puppies with less severe clinical signs consists of enrofloxacin, ampicillin, metoclopramide, and maropitant with SQ LRS twice daily. Their IV protocol consists of enrofloxacin SQ, cefazolin IV, maropitant IV, and LRS with metoclopramide and dextrose as a CRI. They also give hetastarch if the total protein is below 3.

Many other shelters and rescue organizations have been very successful at treating parvo virus and saving the lives of many of our most adoptable animals. Euthanasia is no longer the only option for this population. Working together we have been able to accomplish what was once thought impossible.

References

Upper Respiratory Infections (URI) can be a frustrating and extremely costly problem in shelters. The financial costs are easy to measure by looking at the cost of drugs to treat the disease and the amount of staff necessary to maintain isolation wards full of ill cats. The other costs are harder the measure. The increase in suffering and loss of life are dramatic. The emotional toll it takes on employees to care for sick cats only to often see them die cannot be measured. The reputation of the shelter suffers in the community, which may lead to fewer adoptions and compound the problem as fewer cats are leaving the shelter. While many shelters are successfully managing their cat populations and keeping them happy and healthy, there are also many that are not. In East Tennessee, we are seeing many shelters with URI rates nearing 100%. We see the employee burnout; we see the cats suffering and getting so ill that the only option left is euthanasia. This is a very preventable problem. The first step is recognizing that this is truly a welfare issue that needs to be addressed immediately and not just a “kitty cold”. While veterinarians recognize this and can see the suffering these cats endure, we need to remember that many shelters workers do not. Education is the key to improving feline welfare.

The pathogenic causes of URI in animal shelters are primarily Feline Herpesvirus type 1, Feline Calicivirus, Bordetella bronchiseptica, Chlamydophila felis, and Mycoplasma felis. It is important for veterinarians to have a basic understanding of each of these pathogens and an understanding of how proper disinfection and cat handling can decrease fomite transmission of illness. It is also vital that the practitioner understand the latency and recrudescence of FHV-1 specifically. In most cases, however, it is not necessary to know which of these pathogens is causing illness in the population. Testing can be prohibitively expensive, and infections are often caused by more than one organism. Also, these organisms are so common that in the short time it takes to receive test results another infectious organism can be introduced to the shelter. If the shelter is experiencing an abnormal or especially virulent outbreak of URI, a combination of an oropharyngeal and either conjunctival or nasal swab can be submitted for PCR testing. PCR testing has been shown to be a sensitive method for detection of the infectious agents in cats.\(^1\)

One of the first things I recommend doing before implementing any changes is to determine the current disease rate. If good data tracking has been previously implemented, this will be as easy as determining the percentage of cats that have shown symptoms of URI after being admitted to the shelter. Incomplete data sets aren’t necessarily very helpful when monitoring illness, but there is great potential for shelter software to track the frequency and risk factors for URI.\(^2\) This data collection will look different for different shelters, based on intake and release statistics as well as which software system is used. This can be difficult with paper records but is possible. At a minimum track the number of cats that develop URI signs and on what day it is first recognized. Also note health status on intake and at final disposition.

Having accurate data is useful for many reasons. Not only can it help determine the true rate of disease in the shelter, but it can be used to determine if a certain age group, housing area, or other defining factor is increasing disease risk. The rate of disease is important to have before you start to implement changes. While we can easily look in a shelter and know that it has a problem with URI, it is difficult for us to assess over time if that problem is improving. Having accurate data can be used to determine if the changes being implemented are effective and if they are causing any secondary benefits or concerns. Employees that are experiencing burnout or compassion fatigue will be reluctant to change, and allowing them to see the numbers and recognize that changes are helping cats may go a long way in convincing them to make further changes. Without data it may be hard to prove the benefit of your work.

In most areas, cat intake is seasonal so a year’s worth of data would be ideal. Watching cats suffer for a year without making changes is not an option, however. Many times we collect as much data as we can while we work on plans to alleviate other immediate concerns, always remembering that the welfare of the animals is our primary focus.

The relationship between overcrowding in shelters and clinical signs of URI has been widely discussed for some time. One of the ways to lower overcrowding is to lower the intake of cats. In many municipalities the stream of cats coming into the shelter seems never-ending and is often more than can possibly be adopted or sent to rescue. The financial and emotional burden of caring for these cats is great. One unfortunate sequela is that employees do not want to have to euthanize these animals so shelters turn into “warehouses” for them to live until they get sick and need to be euthanized. This takes the control of which cats we devote our time and resources to out of our hands. A lot of this can be cured by lowering intake and making appropriate population management decisions at intake.

Effective Shelter-Neuter-Return (SNR) programs can lower shelter intakes, euthanasia rates, and allow for more resources to care for cats that do develop URI while in the shelter.\(^3,4\) Setting up SNR programs can be a big undertaking, but many grants exist to help and volunteers are available in nearly every community to assist with programs. A simple internet search can find numerous resources.
available to those wishing to set up SNR programs in their communities. Some communities may find SNR programs to be the more financially sound decision when choosing between SNR and Trap-Kill.

Geographic information systems (GIS) mapping is proving to be an excellent tool for determining where intakes are clustered and focusing outreach resources. Analyzing GIS data to determine where specific groups of animals (i.e. owner relinquished adult cats, kittens, cats that are unhealthy on intake, etc.) can help the organization target specific areas in an effort to decrease those specific types of intakes.

Managed admission is a relatively new concept that a lot of shelters either fear or believe they can’t implement in their organization. The University of Wisconsin Shelter Medicine Program has an excellent online video series that includes a lecture on managed intake. I would encourage any shelters considering this to watch the presentation on their website. Carefully managing the flow of animals into the shelter will allow resources to be allocated efficiently and allow the shelter to better stay within their capacity for care.

Many other opportunities for managing URI happen at intake. These include vaccinating all cats over 4 weeks old with a modified live FVRCP vaccine, performing intake examinations that closely check for signs of infectious disease, making appropriate housing decisions to decrease the amount of times a cat has to be moved, and designating cats as fast track or slow track to help decrease length of stay. Careful handling of all cats during the intake process is also important to decrease their overall stress level and prevent reactivation of herpavirus. Ideas for writing successful intake protocols can be found in my lecture in these proceedings.

Stress is a primary contributing factor to cats developing URI in the shelter because any source of stress can decrease immune function and increase the susceptibility to illness. This stress can be related to inappropriate housing, increased length of stay, poor nutrition, moving cats often, poor air quality, poor cleaning and disinfection practices, excessive noise, a lack of proper enrichment, and many other aspects of day-to-day shelter operations.

Humane housing should be at the forefront of any URI management plan. Recent work at UC Davis has shown that cage size is related to infection rates as well as to euthanasia rates. Large cages can help make cats less stressed, less likely to get sick, and less likely to be euthanized. Further research looked at multiple risk factors for development of respiratory infections in cats and found that inadequate floor space was one of the primary risk factors. It is recommended that individual cat kennels have 9 square foot of floor space with separation between food, resting, and elimination areas. This research has yet to be published, but is very exciting news for animal shelters because it strongly suggests that if we operate within our capacity for care and provide adequate housing we could significantly lessen the burden of URI.

Elevated space, hiding boxes, open kennel sides, outdoor space, appropriate litter boxes, and separated eating and elimination areas are all important housing considerations. Careful, planned group housing is also important and should be reserved for cats over 5 months old that are social with other cats.

The longer a cat stays in a shelter, the more likely it is to develop clinical signs of respiratory disease. Thus, lowering the average length of stay (LOS) should also be at the forefront of any URI management plan. Addressing housing concerns will have the secondary benefit of lowering LOS. In many shelters, larger housing for cats involves making portals in kennels. Portalizing kennels often means that the organization needs to find its adoption driven capacity and find ways to maintain that capacity. Finding and maintaining that capacity will lower the LOS. Lowering the LOS will lower URI. The opposite is also true; lowering URI also lowers LOS since cats are not sitting in isolation wards for 1-2 weeks. From personal experience, I have found that cats that are healthy are much more likely to get adopted quickly. This will also lower the LOS. Problems in animal shelters are often said to be never-ending cycles where one problem leads to another, causing a domino effect. Solutions in animal shelters can be seen the same way. One positive change will lead to another, and the cycle will continue. Improving housing, lowering LOS, and lowering URI rates can be viewed in this way.

Rehousing cats often and disinfecting their entire kennel daily causes enough stress to cause a reactivation of latent FHV-1. Cat moves can be made less stressful by bringing a hiding box and bed with them from one kennel to the next. Moves can be made less frequent by determining if a cat will be fast track or slow track during the intake exam and moving them to the appropriate area immediately. Open selection is another means of moving healthy, adoptable cats immediately to the adoption area when they are on stray hold. Cleaning kennels using spot cleaning protocols decreases rehousing stress for the cat and will decrease the amount of staff time required to clean cat holding areas.

Air quality is a concern in many shelters, especially those that are older and were not initially designed to be shelters. For many years, we relied on air filters and air turnover to improve air quality. Proper ventilation is important, but we should be looking beyond that. Fresh air should be used whenever possible. This includes outdoor space and open windows. We also need to pay attention to cleaning protocols and ensure that we are not causing poor air quality by spraying chemicals that may irritate upper airways in areas where animals live. Overcrowding can also lead to poor air quality as litter dust and odors are abundant.

Behavioral enrichment should not be forgotten when considering feline health. As veterinarians, we should always remember that an animal is not truly healthy unless it is emotionally and physically healthy. We must meet those emotional needs in order to truly provide humane care. A couple of very interesting studies have been published that have shown that cats that enter the shelter content
are more likely to stay content if provided with daily human interaction.\textsuperscript{19} Also, cats that enter the shelter anxious may experience more contentment if gentled.\textsuperscript{20} More research needs to be completed, but this strongly suggests that positive human interactions may lead to lower incidence of URI. A trend that is becoming popular is to have children read to and pet cats in after school programs. Anecdotal evidence is showing benefits for both the cats and the children.

Further measures that could be taken include dampening all noise, ensuring all cleaning protocols disinfect while causing low amounts of stress, providing a high quality consistent diet that is age-appropriate, and allowing staff and volunteers the time to interact with cats and potential adopters.

Daily rounds to monitor the health and behavior of every cat in the shelter are important to URI management and to shelter health as a whole. These rounds should include checking every cat for signs of infectious disease and also checking to ensure the cat is eating. If it doesn’t cause undue stress, cats should be weighed weekly to monitor for weight loss. Weight loss increases as stress scores increase and may be an indicator that a cat is at risk for URI.\textsuperscript{21}

The first and most important thing to remember about treating URI in the shelter is that your focus is on the population and the health and welfare of every cat in the shelter. Some shelters are fortunate enough to have many resources available to them, including the funding and staffing to run isolation wards. It is important to remember that no matter how well you can manage these wards they should be empty.

In order to ensure the most humane care of individuals while maintaining the absolute best welfare for the population, protocols need to be clear and concise to everyone involved in decision-making. At what point a cat is moved to isolation, when antibiotics or other medications are started, when other supportive care is warranted, and at what point euthanasia is considered are just some of the considerations that need to be in this protocol. Staff members will often disagree on these decisions, and even staff veterinarians may have disagreements. Clear, written protocols will ensure fair and equal treatment for all cats, prevent the overuse of antibiotics, and allow for rational decisions when it comes to transfer or euthanasia.

The best example of a treatment protocol I have found was written by Dr. Cindy Karsten and is available at: [http://www.sheltermedicine.com/library/uri-sample-treatment-protocol](http://www.sheltermedicine.com/library/uri-sample-treatment-protocol). This protocol can easily be adjusted to meet the needs of your shelter and your preferences for treatment. For many of our shelters in East Tennessee, advanced treatment is not an option, and a veterinary consult for euthanasia has replaced some of the later treatment options. Where that line is drawn depends on the live release rate at your facility as well as the resources you can allocate to the treatment of cats. Nearly every shelter can use some aspect of this protocol, however, even if they use it only to decide when cats go to isolation and which cats would benefit from antibiotics. For private practice veterinarians that work off-site, you will need to check local and state laws to determine if staff members are allowed to start antibiotics when you have not seen the patient.

Debate has surrounded the use of L-lysine, interferon, cefovecin and antivirals in the prevention and treatment of respiratory infections in shelter cats. L-lysine has been shown to not be effective at controlling URI in shelters.\textsuperscript{22,23} Interferon has been studied as a potential therapeutic option, but more research needs to be done in shelter situations. Cefovecin injections would likely be less stressful than oral medications for both cats and staff, but doxycycline and amoxicillin-clavulanic acid have both been shown to be more effective therapies.\textsuperscript{26} Famciclovir has been shown to improve outcomes but controversy surrounds its use in shelters. It has been shown to be safe and well-tolerated, but drug-resistant strains of FHV-1 have been described so it should be used with discretion. Also, a single dose of famciclovir at intake has been shown to not be effective at preventing respiratory infections.\textsuperscript{29}

It cannot be stressed enough that the goal of URI management is prevention rather than treatment. By maintaining the shelter’s capacity for care and allocating resources to improving the husbandry of all cats, you can maintain a happy, healthy feline population without utilizing resources on extensive treatment and isolation wards.

References

Sheltering Starts When They Enter the Door: How to Implement a Health Intake Protocol

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The first thing shelters tend to ask is if they need a formal intake protocol. The answer to that question is always yes. Written, standardized protocols are vital to shelter operations to ensure the flow is running as smoothly as possible and good decisions are being made by all employees and volunteers. While many gray areas exist in sheltering, the more we can keep things black and white the fewer mistakes will be made and the less we will see decision fatigue in our staff. Many decisions are made for animals as soon as they walk in the door (and sometimes before) and it is vital that these decisions are based on sound practices and not emotional state.

Intake protocols are necessary for maintaining a healthy shelter population. The behavioral and medical needs of the animals in your care need to be assessed immediately to allow for smooth flow through the shelter. Intake protocols help designate those animals that may need more care and those that can move through the shelter quickly. Allowing these decisions to be made immediately will help the shelter avoid bottlenecks in every other area of the shelter. Intake protocols are also necessary to prevent infectious disease, to control parasites in the shelter, to ensure proper nutrition of shelter animals, and to maintain a safe atmosphere for visitors and volunteers.

Many times “intake” starts before the animals enter the shelter. Many welfare organizations struggle with deciding how to schedule proper staffing for intake, which animals will be able to find homes, and how to divert animals when the shelter may not be the best option for them. While these struggles vary shelter-to-shelter based on many factors a balance must be achieved within each organization. Many times this includes utilizing targeted TNR or outreach programs to reduce intakes from certain areas, using diversion protocols to keep animals out of the sheltering system when that is not the best option for them, managing admission so staffing can be adequate to ensure protocols are followed, and offering programs like finder to foster that allow those that find animals to foster them until they are able to successfully move through the shelter. An added bonus of some of these programs is that it allows vaccinations to be given in advance of admission to the shelter, giving the animal the benefit of immunity to some infectious diseases prior to intake.

The first place to start is to assess emergent needs. If emergency medical care is needed, a veterinarian should be notified before any further work is performed. As long as the animal appears stable, the intake procedure can be followed as written. Written behavioral and medical history is important for many reasons. A standard questionnaire should be given to owners or “finders” when they turn an animal into the shelter. Studies have shown that information provided by relinquishing owners is sometimes correlated with the post-adoption behavior. Those that have recently found animals may have little knowledge about them, but any information they can provide will be valuable. It is also very important to note where the animal was found and what it was doing when found. This is also a time to discuss the reasons for relinquishment and offer any available diversion programs.

Next, a brief physical exam should be performed. This exam needs to include age, sex, and reproductive status, signs of illness or injury, and noting any tattoos or microchip. In areas where dermatophytosis is a concern a Wood’s lamp examination should be performed on incoming cats, and a protocol should be in place for what to do if that test is positive. Because microchip scanners are not 100% reliable, it is recommended that animals be scanned for a microchip on at least two occasions during processing.

Animals should be vaccinated with age-appropriate vaccinations. It is recommended that all dogs over 4 weeks old are vaccinated with MLV DHPP at intake. All dogs and puppies should also be vaccinated with a modified live intranasal vaccine containing at least Bordatella bronchiseptica and Canine Parainfluenza on intake. This vaccination can be given to puppies as young as 2-3 weeks old. All cats over 4 weeks of age should be given a MLV FVRCP vaccination upon intake. For pregnant animals and other groups where vaccination may create risks, the risk of vaccination needs to weighed against the risk of the animal being exposed to a potentially fatal disease. For dogs, shelters may choose to run serology or foster pregnant bitches outside the shelter. Pregnant queens are often vaccinated and spayed or sent to foster homes where they can avoid exposure. Protocols for such situations are shelter-specific and highly dependent on live release rates and the ability of the shelter to adopt out those animals as well as the risk of exposure to disease in that shelter. Because mishandling of vaccinations is thought to be a primary cause of vaccine failure, a refrigerator needs to be
easily accessible and designated for non-food use and all staff need to be trained on the importance of proper vaccine handling and administration.

Parasite control measures are important for many reasons and should also be written into intake protocols. Many parasites are ubiquitous and some can cause serious illness. Parasites may also reduce disease resistance so other pathogens can cause concomitant disease, and some have zoonotic potential. Preventative measures depend on the geographic location of the shelter and what parasites are likely to be present in that region. At a minimum, all dogs need to be treated for round and hook worms. For many shelters, oral pyrantel is given to all animals as well as topical or oral flea and tick preventatives. Many shelters are also finding it useful to administer pneumonia to all animals or all puppies and kittens on intake. Online resources are available to help with dosing this medication. Shelters that see high numbers of specific parasites may elect to also treat for those parasites at intake.

Venipuncture may or may not be part of the intake exam. In many situations, this is done at the time of the veterinary exam because animals are stressed during intake, and staff may not be trained well enough to master the procedure. Multiple attempts by untrained staff may cause substantially more stress for the employees and the animals. If animals are fast-tracked and placed directly into adoption, the shelter may wish to perform heartworm testing on dogs and FIV and/or FIV testing on cats during the intake process. If cats are to be moved immediately into group housing, testing will need to be performed before the cat is moved. If these diagnostics are part of intake, ensure that all staff are properly trained to perform venipuncture and perform these diagnostics. Errors that cause false positives or false negatives could be life-threatening.

Behavior testing should be used as early as 18 hours post-intake. Researchers have shown that 20% of dogs display stress signs even when handled by medical staff.13 Some shelters are choosing to test dogs at time of intake, which may be problematic if the dog is displaying signs of stress. An ideal time hasn’t been determined for behavior testing yet, but should be avoided in the stressed dog. Many shelters are choosing to perform this testing 2-3 days after the dog arrives at the shelter, and many are electing to forgo behavior testing and instead using the dog’s behavior during examination and handling to determine its eventual outcome. Behavior can be more difficult to determine in cats. To the untrained employee, a frightened pet cat may appear to be feral. One survey found that as low as 15% of shelters have written guidelines for assessing cats.13 Protocols for assessing feline behavior that include time for stressed cats to acclimate need to be in writing, and all employees need trained to properly and fairly perform these assessments. One assessment that is used in many shelters is the research-based ASPCA Feline-ality. It has been shown to work well in a modified form that can be used as early as 18 hours posts-intake. Behavioral assessment and modification is a rapidly emerging and important aspect of shelter medicine that cannot possibly be fully covered in the confines of this lecture. The reader is encouraged to do further research into the subject area before determining which behavior assessments to use in their shelter and at which point in the animal’s stay to perform such testing.

Next the intake team member needs to determine a pathway for the animal and assign housing. Assigning housing immediately allows for less animal movement which lowers the stress the animal experiences while in the shelter and decreases the amount of work the shelter staff have to do later. It also allows for easier flow through the shelter. If the animal is housed in isolation due to signs of infectious illness or has any other medical concerns, the medical team needs to be alerted. Prompt treatment of medical problems can lead to an animal being cleared for adoption faster.

Assigning a pathway and housing is another area where clear and concise protocols are necessary. Repeatedly making life and death decisions is extremely stressful for staff, and defined protocols can help alleviate that burden. Assigning the initial pathway at intake will identify those slow track animals that may need additional resources, including behavioral or medical intervention, or may need promoted and highlighted as soon as possible. It also protects the most vulnerable population (puppies and kittens) by allowing them to move through the shelter quickly. Animals that are likely to have longer stays can be assigned to larger housing with more enrichment, and cats that will likely be at the shelter for longer periods can be moved into group housing if available.

Determining which animals are likely to get adopted quickly is very shelter-specific. This used to be determined by the local community, but with more adopters using the internet and driving long distances to obtain their perfect animal, this is no longer the case. People adopt animals for a number of different reasons including general appearance, social behavior, personality, size, sex, coat pattern, color, and in-kennel behavior. One study even showed that people tend to assume “cuter” dogs have better behavioral traits. Overall, it is important for the shelter workers to understand what factors tend to shorten length of stay at their shelters and what factors tend to lengthen it so animals can be properly assigned a pathway. It is also important to understand that adopters do like a variety of animal types so it is a benefit to have a mix of slow and fast track animals in adoption at any given time.
The importance of accurate records and cage cards cannot be stressed enough. It is very important that the staff member take the time to complete a full and accurate record before moving on to the next arrival. If time elapses and the worker sees more animals before going back to the record, it can be assumed that the risk of errors rises. Inaccurate medical records could cause many devastating outcomes, including an owner not being able to find a missing pet or an animal being mistakenly euthanized.

After the intake process is complete, the surfaces in the intake room need to be disinfected, allowing enough time to permit proper contact time. The intake room should be fully disinfected after the arrival of an animal showing signs of infectious disease and at the end of every day.

Most shelter workers can read these recommendations and understand the necessity for each step in the process. Unfortunately at many shelters these steps are not followed. Often this is not the result of people being unwilling to perform intake procedures properly but is simply a result of shelter staff being overburdened with the amount of intakes and the inconsistency with which they arrive. As mentioned previously, there are many ways to improve this and help maintain the shelter’s capacity for care.

Effective Shelter-Neuter-Return (SNR) programs can lower shelter intakes. Geographical information systems (GIS) mapping is proving to be an excellent tool for determining where intakes are clustered and focusing outreach resources. Analyzing GIS data to determine where specific groups of animals are coming from can help the shelter target outreach efforts aimed at those populations in an effort to decrease those types of intakes. For example, if data analysis reveals that most puppies are coming from one area of the city, and those puppies have higher than average rates of parvoviral enteritis, the shelter could focus spay/neuter and low cost vaccination resources in that area. Monitoring that data could determine if those outreach efforts were working to decrease intakes and infectious disease rates in the shelter.

Managed admission is a concept that a lot of shelters either fear or believe they can’t implement in their organization. The University of Wisconsin Shelter Medicine Program has an excellent online video series that includes a lecture on managed intake. I would encourage any shelters considering this to watch the presentation on their website. Carefully managing the flow of animals into the shelter will allow resources to be allocated efficiently and allow the shelter to better stay within their capacity for care.

Managed admission and diversion programs go hand-in-hand. The shelter is not the best option for many animals, especially if admitting those animals will mean the shelter operates at above their capacity for care. People need to be educated on other options that exist for re-homing their animals. Pet food pantries, assistance with medical costs, and maintaining lists of housing that is pet friendly are just a few of the ways to help keep pets with their families. Outreach services that will work vary greatly by community, and organizations may need to be creative to find the best ways to keep animals out of their shelters.

Any written protocol should be based on the individual sheltering organization’s needs with the ultimate goal of preventing compassion fatigue and ensuring the best possible outcomes for the animals in the shelter. Improving welfare while minimizing suffering should be at the heart of all shelter protocols.

References
What is Titering All About:
A Simple Approach to Managing Outbreaks
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Canine Parvovirus (CPV), Canine Distemper Virus (CDV), and Feline Panleukopenia Virus (FPV) are all historically devastating pathogens in the shelter setting. Many shelter workers fear the introduction of these viruses into their populations. While they can be devastating to the individual, proper prevention of disease and management of outbreaks can keep the infections from devastating the population. Protocols for daily operations and outbreak management can save not only lives but also the reputation of the shelter.

A full review of each virus is not necessary, but understanding certain characteristics of these pathogens is important to a discussion about infection control and outbreak management.

Canine Parvovirus (CPV) has a relatively short and defined incubation period. Most dogs will develop clinical signs within the first week of infection, but the incubation can be as long as 14 days. Clinical signs of disease are straight-forward and include vomiting, diarrhea, lethargy, and dehydration. Diagnosis is relatively inexpensive and can be performed in-house. A fecal enzyme-linked immunosorbent assay (ELISA) antigen test is often performed in conjunction with a blood smear for more accurate diagnosis. CPV is very sturdy and can survive long periods of time in the environment. Despite the name, cats can be infected with CPV. The virus may cause clinical signs in this species or they may act as a reservoir and source of environmental contamination.

Feline Panleukopenia Virus (FPV) has a relatively short and defined incubation period. Most cats develop clinical signs within 7-10 days, but the incubation period can be as long as 14 days. Clinical signs of disease include vomiting, diarrhea, dehydration, lethargy, and sudden death. In-house tests for canine parvovirus in feces have been shown to be diagnostic for FPV in cats, and the IDEXX SNAP Parvo test has been shown to have minimal vaccine interference. White blood cell counts and necropsy also aid in diagnosis. FPV is very sturdy and can remain in the environment for long periods of time.

Canine Distemper Virus (CDV) has a long and poorly defined incubation period. Clinical signs may be apparent in 1-2 weeks or may take more than a month to develop. The signs of disease can mimic “kennel cough” and be missed in a shelter than often seen upper respiratory infections in dogs. Signs vary greatly and can involve multiple organ systems. Simple, accurate in-house diagnostics do not exist, further complicating proper diagnosis. CDV is less sturdy and easier to remove from the environment, but recovered dogs can shed the virus for months and recontaminate a shelter post-outbreak.

Despite the obvious differences, there are many commonalities among these viruses. There is a constant threat of introduction into the shelter and plans must be in place to prevent their spread. All of them increase suffering, death, and euthanasia. They cause morbidity and mortality in otherwise healthy and highly adoptable animals. Antibody titer tests are available for all of them, however, and vaccinations are highly effective and quickly effective if administered properly.

Epidemiology Review

A review of terminology related to epidemiology is also pertinent to this discussion. First, outbreak (or epidemic) refers to a sudden increase in the number of cases above what would normally be expected in a population. An epidemic curve can be used to plot the number of affected animals in a population over time. In shelters with good prevention protocols and high community vaccination rates, many infectious diseases could be labeled as sporadic, meaning that you see them infrequently and irregularly. In shelters with good prevention protocols but low community vaccination rates infectious diseases could be endemic, meaning that they are a constant presence in your shelter in low numbers. In shelters with poor prevention protocols and low community vaccination rates infectious diseases could be hyperendemic, meaning that you see persistent, high levels of disease occurrence. If you think you may have an outbreak but have not tracked your normal disease rates, you have a cluster.

Another valuable tool is the attack rate. Measuring the attack rate is relatively simple and done by dividing the number of cases by the total population. This is very useful in shelter disease outbreaks because the attack rate can be determined for various risk factors to help determine potential causes. For example, the attack rate could be determined for cohorts of animals transported from different shelters or for all animals in one specific holding area. If vaccine failure is suspect, attack rates for animals vaccinated by different people or on different days could be determined. This is a simplified explanation, and the reader is encouraged to review the courses available at www.cdc.gov for further information.

Outbreak Prevention

The best way to prevent suffering, decrease euthanasia, decrease the financial burden of disease, and prevent compassion fatigue in shelter workers is to prevent infections rather than to treat them. Some shelters may feel that prevention is expensive and time-consuming but will often find that outbreaks prove to be much more expensive and exhaustive for staff. If day-to-day operations include disease prevention protocols, single cases of CPV, CDV, and FPV will remain single cases and not become outbreaks.

In many shelters, especially where vaccination rates in the community are low, all three of these viruses will occasionally be introduced into the facility. Animals may present either displaying clinical signs or in the incubation or pre-clinical phase. With
properly trained personnel and strict intake protocols many of those displaying clinical signs can be prevented from infecting others. Training intake staff to immediately recognize the signs of infectious disease so these animals can be isolated from the population is vital to any infectious disease prevention protocol. But it is not possible to determine which animals may be incubating disease and may start shedding virus after admission.

Shelters should assume that all animals are naïve to infection and treat them as such. One study in Florida found 64.5% of dogs admitted to the shelter had insufficient antibody titers for CPV, CDV, or both. A similar study in cats found that most cats were seronegative for antibodies against FPV at the time of admission to an animal shelter. These studies support the current recommendation that all dogs over 4 weeks old should be vaccinated for both CDV and CPV on intake and all cats over 4 weeks old should be vaccinated with a MLV FPV vaccination on intake. In puppies, DHPP should be repeated every 2-3 weeks until 18-20 weeks of age. Adult dogs can be revaccinated 2-3 weeks after intake. For kittens, FVRCP should be repeated every 2-3 weeks until 18-20 weeks of age. Adult cats can be revaccinated 2-3 weeks after intake. For more information on intake and vaccination protocols, see the intake lecture in these proceedings.

Outbreak management plans should exist for each infectious disease and need to include a plan to move forward after diagnosis. The diagnosed animal needs to be immediately isolated or euthanized, the area promptly disinfected, and other animals closely monitored for signs of illness. These studies support the current recommendation that all animals are naïve to infection and treat them as such. One study in Florida found 64.5% of dogs admitted to the shelter had insufficient antibody titers for CPV, CDV, or both. A similar study in cats found that most cats were seronegative for antibodies against FPV at the time of admission to an animal shelter. These studies support the current recommendation that all dogs over 4 weeks old should be vaccinated for both CDV and CPV on intake and all cats over 4 weeks old should be vaccinated with a MLV FPV vaccination on intake. In puppies, DHPP should be repeated every 2-3 weeks until 18-20 weeks of age. Adult dogs can be revaccinated 2-3 weeks after intake. For kittens, FVRCP should be repeated every 2-3 weeks until 18-20 weeks of age. Adult cats can be revaccinated 2-3 weeks after intake. For more information on intake and vaccination protocols, see the intake lecture in these proceedings.

Overcrowding increases the stress an animal experiences and increases the dose of pathogens they are exposed to in the shelter. Chronic stress from overcrowding can lower the animal’s resistance to infection by compromising the immune system. Overburdened shelter workers may be less likely to follow sanitation and disinfection protocols properly. These are just some of the factors that illustrate how important it is to maintain the capacity for care in order to prevent infectious disease spread. Shelters need to determine their capacity for care and stay within that capacity in order to minimize disease risk and improve welfare.

Cleaning protocols need to be written, easy to understand, and accessible by all employees. Proper training should be provided to every employee and follow up should be done routinely to ensure these protocols are being followed. Disinfectants need to be parvocidal, and all contact times need to be followed exactly as written. Understanding the nature of the disinfectant is important and all recommendations need to be followed when writing protocols. Dilution procedures, how well disinfectants work in the face of organic material, and storage instructions all need to be considered when writing protocols. More information on the importance of proper sanitation and a table of disinfectant properties can be found on the Koret Shelter Medicine Program website, www.sheltermedicine.com.

Animal housing and socialization also needs to be considered. Juveniles should be in separate areas than adults, and animals showing clinical signs of disease should be isolated from the rest of the population. Double compartment housing should be used not only to reduce stress but also to allow for cleaning with minimal animal movement and handling. Dogs should not be allowed to intermingle until approved by the veterinary staff. Play groups have become a very popular addition to dog behavioral enrichment but should be reserved for vaccinated adult dogs. Socialization is extremely important for puppies but needs to be done in a manner that does not risk exposing them to disease. All volunteers and staff that enter puppy kennels for socialization periods should be trained in appropriate disease control measures. Also, cats and dogs should never be housed together in the shelter for many reasons including the risk of spreading illness between the species.

Daily medical rounds to monitor the health of all animals in the shelter will also help prevent spread of disease. At least once daily, someone trained in signs of infectious disease should observe every animal in the shelter, looking for any indication of disease or distress. This practice will allow animals displaying clinical signs of illness to be immediately placed in isolation and examined by veterinary staff, which could prevent the spread of disease to others.

Outbreak Management

Outbreak management plans should exist for each infectious disease and need to include a plan to move forward after diagnosis. The diagnosed animal needs to be immediately isolated or euthanized, the area promptly disinfected, and other animals closely monitored for signs of illness. If more cases are detected and it is determined that an outbreak is occurring, the full outbreak management plan should be immediately put into effect. The more rapid an outbreak response, the more potential exists to mitigate damage.

The first thing that is often done is to stop movement until risk can be assessed. This involves stopping intake if possible and closing adoption temporarily. For open intake shelters, strays must still be taken but owner releases can be put on a waiting list. Stray puppies or kittens should be vaccinated and fostered without entering the shelter if possible. If intake must continue, it is important to make a clean break. This will involve either a temporary facility or moving enough animals to clear and disinfect part of the shelter prior to taking more animals in. In order for it to truly be a clean break, there must not be movement of staff, supplies or animals from one area of the shelter to the other.

Risk assessment is an area of confusion for many people. The goals of risk assessment are to allow for movement of animals through the shelter and to decrease euthanasia. It was not long ago that outbreak management for these viruses was to close the shelter, depopulate, clean, and re-open the shelter. Unfortunately, that practice is still in place in many shelters across the country. Modern risk assessment allows shelters to move beyond that outdated practice.

Many factors need to be considered when determining an individual’s risk. The individual’s immune status, vaccination status, likelihood of exposure and proximity to the infected animals should all be taken into consideration as well as the cleanliness of the
environment. The shelter population can be divided into four groups: 1. Those that are infected. 2. Those that have been exposed and are at risk. 3. Those that have been exposed but are not at risk of developing infection. 4. Those not exposed. Infected animals need to be removed from the general population immediately and either isolated and treated (on-site or off-site) or euthanized. Euthanasia of otherwise healthy, young animals is difficult but if proper isolation facilities that can provide adequate care while safeguarding the rest of the population do not exist, euthanasia is the most humane option. Those known to truly not be exposed could be assumed to have the same risk as an animal that enters the facility in a non-outbreak period as long as they continue to be maintained in a manner that prevents exposure. Serology is a useful tool to determine which animals fall into the second and third groups.

In-house antibody titer testing is relatively inexpensive with high diagnostic accuracy for CDV and CPV and is thus a valuable tool for outbreak response. Two point-of-care tests currently available are the Synbiotics TiterCHEK™ and the Vaccicheck ImmunoComb™ test by Biogal. TiterCHEK™ is a non-quantitative well test kit, and the ImmunoComb™ is a semi-quantitative dot ELISA titer test kit. Much of the available research has been performed using the TiterCHEK™, likely do to the more recent release of the Vaccicheck ImmunoComb™

One test commercially available for CPV testing (Synbiotics TiterCHEK™) was proven to be inappropriate for use in cats due to its low sensitivity for FPV antibodies. The same study found the point-of-care ELISA test available for cats only identified about half of cats with a protective titer for FPV. A later study did show better specificity, which could be due to modifications to the test, but the specificity for detecting antibody titers of 1:20 was still only 89%. Laboratory testing takes longer but is the most accurate way to measure antibody levels in cats.

Serology should be reserved for exposed animals that are not displaying clinical signs of disease. Risk categories for exposed asymptomatic animals can be assigned in the following manner:

- **High Risk:** Any age animal not displaying clinical signs with a negative titer.
- **Intermediate Risk:** Puppies and kittens less than 5 months old with no clinical signs and a positive antibody titer.
- **Low Risk:** Adult animals with no clinical signs and positive titer results.

Animals that are not displaying clinical signs but have a negative titer are high risk and need to be placed in quarantine for 14 days (CPV, FPV) or 4-6 weeks (CDV). Juveniles should be bathed at the beginning and end of the quarantine period. The bath at the beginning of quarantine is particularly important to avoid exposure to pathogens in the feces on their fur as maternal antibody wanes. To help avoid unnecessary long quarantine periods, antibody titer testing for CDV can be combined with PCR testing to further assess risk and potentially move more animals through the shelter, especially if the consulting veterinarian becomes involved later in the course of the outbreak. Because the incubation period for CDV varies so greatly, it is often recommended that these dogs be released with a medical waiver even if they have been quarantined for 6 weeks and have shown no clinical signs of disease.

Intermediate risk puppies and kittens can be bathed and immediately placed in rescue, foster, or go out for adoption with a waiver. It is not possible to tell if the antibody titer is due to maternal antibody or vaccination so it is important to get these animals out of the shelter as soon as possible. Low risk adults can be moved to adoption or rescue.

Decontamination is vital as animals are moved according to risk assessment. A common misconception is that kennels need to remain empty for a period of time before they can be used again. Decontamination should consist of multiple cycles of mechanical cleaning and disinfection followed by completely drying the area rather than letting it sit for a specified period of time. Three cleaning cycles with complete drying between cleanings is commonly recommended to completely remove all pathogens.

Communication is another important part of outbreak management. Recent adopters, fosters, employees, volunteers, local veterinarians and potentially the local media all need to be informed of the outbreak and given accurate information. Outbreaks of disease can lead to rumors and a loss of reputation for the shelter. Not alerting local veterinarians or other animal care professionals may lead to secondary outbreaks and further loss of life. Providing accurate and timely information can help prevent further damage and save the shelter’s reputation.

Following an outbreak, it will be necessary to review procedures and identify what caused the disease to spread. Procedures and protocols should be reviewed to ensure all measures are being taken to prevent a future outbreak. If a widespread vaccination failure is suspected, vaccination protocols should be examined. If recovering from a CDV outbreak, any wildlife handling procedures should be reviewed. Protocols need to be amended as necessary and staff training will need to be completed immediately to prevent another outbreak. As with nearly every aspect of shelter medicine, prevention is the goal of these measures.

References


