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SMALL ANIMAL EUTHANASIA: ANALYZING EUTHANASIA PROTOCOLS

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Abstract

Euthanasia is part of a veterinarian's job; a veterinarian may euthanize more than 1,000 animals in his/her career. Yet there is little research in identifying best practices of pet euthanasia. Veterinarians were surveyed about practices/protocols, access to learning materials about euthanasia, and personal and practice demographics. Qualitative and quantitative analysis of the data will inform future research with the intent of identifying characteristics, interpersonal and technical, that support good outcomes for patients, clients and providers.

Acknowledgments

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Background

Techniques

There are many facets to a successful euthanasia, which is defined by the pet passing easily from awake, to asleep, and finally to death. This includes using medication, picking the proper euthanasia technique, and making the procedure high quality for both the patient and the client. The most important note is that every euthanasia is different, and so while veterinarians may use some techniques with one animal, they will use completely different techniques for another.

The first step is deciding whether or not a catheter will be used in the delivery of medication. A catheter can make it much easier and faster to deliver medication, but requires the animal to be taken away from the owner to insert the catheter. This is to assure that clients are not upset by the slight pain their pet might experience at the insertion of the catheter. There can also be problems when a catheter is not placed correctly, but usually the benefits outweigh the risk of this occurring. A catheter also ensures the entire dose of medication will be delivered, even if an animal has weak veins. If a catheter is not being used, an alternate method of delivery must be determined. A butterfly needle is almost always chosen, because it allows the animal to move around and the medication still be delivered. However sometimes butterfly needles aren't on hand, or the veterinarian feels more comfortable using a standard syringe (Cooney, 2012, p. 84).

The next decision is whether there will be physical or chemical restraint. For physical restraint, a muzzle or towel wrap can be used, or a simple hold by a veterinary technician or the client can be used (Cooney, 2012, p. 45). Chemical restraint can be used to calm an animal, and can also have the added benefit of reducing any pain the animal might experience. The types of chemical restraint include pain control, sedation, and anesthesia.

There are two main categories of pain control- opioids and NSAIDs (non-steroidal anti-inflammatory drugs). If an opioid is used, the medication mechanism and dose must be carefully studied, as they can have different effects on different animals. For example, in large doses a cat may have increased motor activity because of the amount of mu (a type of opioid receptor) agonists. In addition, opioids are less effective against sharp pain, so the animal may still experience pain at the insertion of a needle (Cooney, 2012, p. 55).

There are three types of opioid medication that are commonly used: morphine, methadone and pethidine. Morphine is the gold standard, and the other medications are compared to morphine. It works in approximately 10 to 20 minutes, can be used with both cats and dogs, and is given via IV. Methadone is another opioid medication that works quickly (5 min), and reduces the likelihood of vomiting because it doesn't target the Gastrointestinal tract. The reason this isn't the best choice is because it is only approved to work in cats. Pethidine is another medication that works for both dogs and cats, but this medication is not deliverable through IV, and can cause spasming effects (Dugdale, 2010;2011, p.15).

NSAID's are anti-inflammatory medications which also have analgesic properties. These medications are designed for prolonged use, but can also be given in a single dose. There are four main NSAID's used before euthanasia: meloxicam, carprofen, ketoprofen, flunixin. Meloxicam and Carprofen are for either cats or dogs, and can be delivered through IV. Ketoprofen is approved only in cats, and can cause possible clotting issues (Dugdale, 2010;2011, p. 23).

Instead of pain control, a veterinarian could choose to use sedation prior to a euthanasia. Sedation is when an animal can be revived at any time and is relieved of moderate to mild pain

(Cooney, 2012, p.51). This can be used either for safety for the staff, or for pain control for the pet. Sedation has the benefit of allowing the owner to comfort their pet before the animal passes, which otherwise may not have been possible before because the animal was in too much pain. However, sedation has the potential drawback of lowering cardiac output, thus it taking longer for the euthanasia solution to cause death. The medication types that can be used for sedation, along with their risks, are: alpha-agonists, which may cause vomiting; phenothiazines, which may lower cardiac output; benzodiazepines; opiates. Other medications that can be used are inhalant anesthetics including: isoflurane, halothane, and sevoflurane. In addition, sometimes anesthetic medications at a low dose are used as sedatives, including ketamine, telazol, and propofol. These medications do have the ability to sting upon entry, so it's important to warn the owners ahead of time that their animal may experience discomfort (Cooney, 2012, p. 57).

The third option for medication is anesthesia. This is when the animal is unconscious with no pain perception.⁴ There are four stages to anesthesia. The first stage is called voluntary excitement, where the animal is very hypersensitive to everything around them, and thus it's necessary for the environment to be calm. The second stage is involuntary excitement, where the animal can lash out because it doesn't know what's happening and it's brain is simply reacting. This can include vocalizations, biting, and churning of the legs. The third stage is anesthesia, where the animal is unconscious and does not feel pain. The fourth stage is medullary paralysis, which is when the anesthesia is too deep and causes the brain to shut down breathing and heart rate. This last stage is considered an inhumane way to kill an animal (Cooney, 2012, p. 53).

Finally, the last step is to decide what medication will be used to fully euthanize the animal. The most humane and standard method is with an injection of sodium pentobarbital. T-61 can also be used, but this has the possibility of causing the animal to go into respiratory collapse while still conscious if the medication is not delivered slowly enough. Potassium chloride and magnesium sulphate are two medications that can only be used on an anesthetized animal, because the medication itself causes pain. On top of that, muscle paralysis can result from magnesium sulphate, causing the pet to die from lack of oxygen while trying to move it's lungs to breathe. Thus, sodium pentobarbital is currently the euthanasia medication with the least side effects on animals, making it the least painful for the pet (Cats and dogs) (Leary et. al., 2013).

Every year a veterinarian will euthanize about 54 cats and dogs, that's a little more than one a week. It's important for the pet, the client, and the veterinarian that it be done as humanely as possible.

Quality for Patient

Euthanasia is an ancient greek term, roughly translating to "good death" (Cooney, 2012, p. xi). What a good death is perceived as will change depending on how the veterinarian and client feel about the specific euthanasia instance. In most cases, if the pet has an easy transition from life to death, then the people involved in this process will feel better about putting the pet down.

There are three main factors that influence the quality of euthanasia for the patient. They follow the same structure as above: level of physical restraint, chemical restraint, and the euthanasia medication itself.

If an animal is being held down by two different technicians in an unfamiliar location, it is likely to be more stressed. If possible, usually it is better for the pet to be held or at least touched by their owner as the veterinarian delivers the medication (Cooney, 2012, p. 43).

If the pet is extremely stressed or in pain, a type of chemical restraint may help aid their passing. If a pet has been in a lot of pain, they might dislike his/her owners touch, however without

that pain they may welcome the gentle touch of their owner. It is also important to consider how the various medications will affect the delivery of the euthanasia medication.

The specific considerations mentioned previously will have a clear impact on the quality of the experience for the animal. Giving a good death helps ease the conscious of both the client and the veterinarian.

Quality for Client

The client, or pet owner, plays an important role in the euthanasia process. They are the people bringing their pets to the clinic or ER, and the ones that must agree to euthanize their beloved animals. As these pets are often integral members of the client's family, the euthanasia process is understandably a very difficult time for them. Things that can impact the client's experience with euthanasia are the restraint and perceived pain of the animal, the environment, and the treatment of the animal after death.

Restraint of the animal is very important during the euthanasia process. It prevents the animal from dislodging any medical devices, as well as ensures the safety of everyone present. However, it can be distressing for client's to see their animals restrained, especially in their final moments. For this reason, veterinarians aim to use the minimal amounts of restraint necessary, and when restraint is necessary, doing it away from the pet owner (Morris, 2012, p. 53). Often times, these steps allow the client to touch or hold their pet during the euthanasia, bringing comfort to both parties.

When a euthanasia is performed, it is often due to the failing health of the animal. During this time, the animal may seem in pain, which causes the owner distress. As euthanasia is a way to relieve this pain, it is important for the process to seem peaceful. One thing that can upset this perception is the biological processes that the animal goes through upon death. These processes can be discussed with the client beforehand, so him/her are not shocked or upset when these physical changes occur. These processes include vocalization, twitching muscles, continued heartbeat for a short time, release of bowels and bladder, and agonal breaths.⁷ Agonal breaths are especially hard for the client, as it appears their pet is gasping for breath one last time. However, these breaths are completely biological, as "chemicals stored in nerve endings are released, causing occasional muscle twitching in the early postmortem period. Thus, an animal may appear to breathe after the veterinarian has pronounced them dead (Morris, 2012, p. 57)."

Once the patient has passed, the treatment of its remains is another important factor for the client. The body is covered with a sheet with the eyes closed, and later wiped or washed clean. The remains can be put in a box or casket, or can be cremated and put in an urn according to the clients wishes. In addition, there is often an option for paw prints or tufts of hair to be taken for the client to remember their pet by. The treatment of the animal is important because it allows the client to feel as though his/her pet has been treated with respect.

The last main contributor to client satisfaction is the setting in which the euthanasia takes place. One common setting for euthanasia is the exam room. While this room contains everything necessary for the procedure, it can be seen as a cold, clinical setting. There can be lots of foot-traffic outside the room, and many distractions to the animal and client. One alternative to the exam room is the specialized euthanasia room. These rooms are much more private, soothing, and comfortable, aimed to give the client and animal a better experience (Morris, 2012, p. 50). These rooms can make the experience of euthanasia more private and comfortable, allowing the client to experience his/her emotions in a safe space.

Quality for Veterinarian

While it is well known that putting down a pet is agonizing for the owner (client), it is often not recognized that the process of performing a euthanasia may take a toll on the veterinarian. Due to the high volume of euthanasia procedures they perform, there may be an impact on the veterinarian. Not every euthanasia is the same, and some procedures can be more difficult for the veterinarian based on a variety of factors, including his/her morals surrounding the euthanasia, their technical performance, and the perceived reaction by the client.

Morals are perhaps the most important factor in the decision to perform a euthanasia. It is crucial that the veterinarian feel comfortable with the actions his/her have agreed to perform, otherwise the decision may haunt them. A “good” euthanasia is when the animal is severely sick or injured. In these cases, euthanasia is relieving him/her of pain and suffering. These euthanasias often do not cause veterinarians moral distress. There are several reasons a veterinarian may not feel comfortable performing a euthanasia, such as when the decision is financially or behaviorally based.

In the case of a financial based euthanasia, clients may not have the funds to treat a non-life threatening issue, or decide they no longer have the money to care for their animal. In these cases, “Participants often reported that euthanizing for mostly financial concerns felt dirty or unsavory; when decisions were completely separated from finances, euthanizing felt clean and even comfortable” (Morris, 2012 p. 23). Often times to combat this issue, veterinarians will try to persuade clients to give up their animal to a shelter rather than euthanize it.

In the case of a behavior based euthanasia, clients may be struggling with certain habits of their pets, such as barking, scratching furniture, or being very energetic. In these cases, veterinarians often do not wish to agree to euthanasia, as these problems are not life threatening. Often veterinarians will once again suggest giving up the animal to a shelter, where it can be given a new home.

Once the veterinarian has agreed to perform the euthanasia, the next factor influencing the veterinarian is the technical performance. Many things can go wrong during the euthanasia process. The animal may struggle, the medications may not work, or the medical devices may be faulty. If any of these things occur, it can make the euthanasia much more stressful for the veterinarian. In contrast, if everything proceeds as planned, the veterinarian is likely to feel as though the procedure went well.

The last factor to veterinarian satisfaction with the euthanasia is how they perceive the process went from the client’s point of view. For a veterinarian, the goal of a successful euthanasia where the client is present is when the animal gently slips into death, and it seems more like the pet is falling asleep (Morris, 2012, p. 51). As this process is a difficult time for pet owners, it is important that they feel the euthanasia went well. If so, this allows the veterinarian to feel as though him/her did well.

Introduction

Euthanasia is an important aspect of veterinary practice, but an area that is not well studied. Due to the nature of the procedure, it can be agonizing for the patient, client, and even the veterinarian.

Euthanasia is an ancient Greek term, roughly translating to “good death” (Cooney, 2012, p. xi). What a good death is perceived as will change depending on how the veterinarian and client feel about the specific euthanasia instance. In most cases, if the pet has an easy transition from life to death, then the people involved in this process will feel better about putting the pet down.

Every euthanasia is different, and while there are manuals that will list medications and techniques, these are purely technical. Is there a way to correctly “learn” how to perform a euthanasia so that everyone is satisfied every time? When performing euthanasia one must be a combination of anesthesiologist, undertaker, and clergy. In the context of a busy day, this process is often an energy and time consuming task.

There are many facets to a successful euthanasia. This includes using medication, picking the proper euthanasia technique, and making the procedure as painless as possible for both the patient and the client. The most important note is that every animal is different, and so while veterinarians may use a protocol with most animals, they might have to use completely different techniques for some cases.

Euthanizing a pet is especially difficult because it is not only the pet that a veterinarian has to consider, but the owners as well. They are grieving and care must be taken so, if they wish, they may spend their last moments with their pet. It is always important to talk through the process with the client as possible vocalizations, twitching muscles, continued heartbeat for a short time, release of bowels and bladder, and agonal breaths can all occur that would upset the client (Morris, 2012, p. 56).

Literature has been written discussing the importance of helping the pet owner through the euthanasia process, (Martin et al., 2004 and Fernandez-Mehler, 2013) as well as on the phenomenon of compassion fatigue that veterinarians and their staff may experience as they perform large numbers of euthanasia procedures (Scotney et al., 2015). However, there has been little researched on the optimal euthanasia protocol specifically for pets, such as whether sedation should be used, and what medications are most efficient and least painful.

This study on cats and dogs is meant to help understand how veterinarians perform pet euthanasia. The study aims to fill in the gaps of knowledge between the different euthanasia techniques, the consequences of these techniques on the animal, as well as understand training that veterinarians undergo. In this paper, we focused on the technical aspects of the euthanasia, discussing what the most used techniques and medications are.

Methods

A draft survey was developed and sent to several individuals as beta testers. The survey focused both on euthanasia protocols and emotional significance, and can be found in Appendix A. Suggestions from the initial review of the survey resulted in the survey being split into two separate surveys. The first included demographics and protocols of the responding veterinarians. More specifically, questions about euthanasia techniques and medications used for dogs and cats were asked, as well as questions about the education of the responding veterinarians. The second survey was aimed at individual euthanasia cases. This survey could be filled out each time a euthanasia procedure was performed on a dog or cat, and asked questions about the difficulty of the procedure and the perceived emotional impacts on the client and veterinarian. These surveys can be seen in Appendix B.

The two surveys were reviewed by both the Tufts University Institutional Review Board and the WPI Institutional Review Board and deemed exempt. The surveys were then distributed in the form of a weblink leading to a Qualtrics survey. Distribution occurred through multiple veterinary listservs and communities: IVAPM, Pet Loss at Home, VCA, Veterinarians at Tufts, Emergency and Critical Care Lists- VECCS, ACVAA, Lap of Love, IAAHPC, VIN, In Home Pet Euthanasia Directory.

For this project, we report here the results on the protocol and demographics survey, while leaving the individual case survey for the sponsor to analyze in the future. The number of responses to the protocol and demographic survey was capped at 557, and then quantitatively analyzed using Qualtrics and Microsoft Excel.

Results

Demographics of Participants

Table 1 shows the demographics of the survey participants. Table 1a show the ages of the participants. The average age is from 31-40 years old, with the next largest demographic group being from 41-50 years old. 80% of respondents were female (Table 1b). In direct correlation with the age, 44% of participants graduated from veterinary school in 2000-2009, while the second highest group graduating from 1990-1999 (Table 1c). The last question asked was “At the time of the survey how many euthanasias do you believe you have performed?”, the responses can be seen in table 1d. The largest group is from 100-500, but 27% of respondents answered with having performed over 1000 euthanasias. Figure 1 shows where the respondents are from. The majority of the respondents were from: Washington, California, Colorado, Wisconsin, Florida, and Massachusetts.

Table 1: **Demographics of Participants**

a

Age	Count	%
20-30	56	10%
31-40	226	41%
41-50	155	28%
51-60	88	16%
61-70	29	5%
Prefer not to say	3	<1%
Total	557	100%

b

At the time of the survey how many euthanasias do you believe you have performed?		
Answer	Count	%
0-100	79	15%
101-500	198	36%
501-1000	119	22%
Over 1000	150	27%
Total	546	100%

c

Year of graduation from veterinary school	Count	%
1970-1979	14	3%
1980-1989	54	10%
1990-1999	109	21%
2000-2009	226	44%
2010-2016	114	22%
Total	517	100.00%

d

Gender	Count	%
Male	106	19%
Female	449	80%
Prefer not to say	7	1%
Total	562	100%

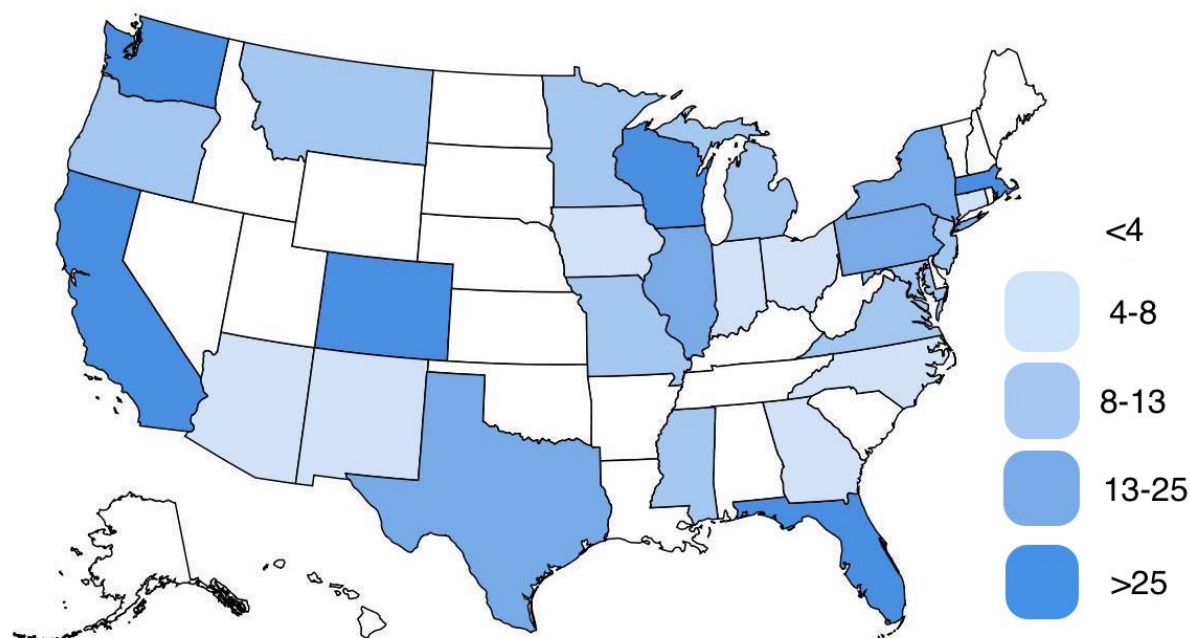


Figure 1: Distribution of Respondents. The survey was distributed by people in Massachusetts and Colorado.

General Practice Information of Participants

Table 2 outlines information about the general practice of the participants. Table 2a describes where the participant normally performs euthanasia. Most are in the hospital and clinic (67%), but some participants do perform house calls (18%), or do both (14%). If the participant performs euthanasia in the hospital, then it is likely that they will have a euthanasia room, as 73% of the respondents answered that they did. Even if the respondent normally performs euthanasia in the hospital, Table 2d indicates if they occasionally also offer home euthanasia appointments. If respondents answered “no” to home euthanasia, which 56% did, a follow up question was asked as to why they did not perform home euthanasia (table 2e). The most common response (48%) was that the practice was an ER facility, specialty facility, or academic and thus it was not in the nature of the business. The second most common response is that the facility does not have enough staff to perform home euthanasia (21%). Table 2b shows responses when respondents were asked if they do not provide home euthanasia appointments, whether they will refer the client to a practice that does. 39% of respondents answer they always make this referral an option, while 42% say they will refer sometimes, if a client asks.

Table 2: General Practice Information of Participants

a

Where do you perform euthanasia?		
Answer	Count	%
Hospital/Clinic	366	67%
House calls	97	18%
Both	79	14%
Other	5	1%
Total	547	100%

b

Do you refer your clients to a home euthanasia service?		
Answer	Count	%
Yes	209	39%
No	99	19%
Sometimes	22	42%
Total	530	100%

c

Is there a specific euthanasia room?		
Answer	Count	%
Yes	326	73%
No	118	27%
Total	444	100%

d

Does your hospital routinely offer home euthanasia appointments?		
Answer	Count	%
Yes	63	12%
No	303	56%
For special individual cases	105	20%
As a major part of my practice	66	12%
Total	537	100%

e

Do you wish to say why it does not?		
Answer	Count	%
ER	43	20%
Specialty	40	19%
Not Staffed	43	20%
Academic	18	9%
Referral Hospital	15	7%
Liability	10	6%
Unsure	9	4%
Other	13	6%
Will refer	18	9%
Total	209	100%

Training of Veterinarians

Table 3 outlines the training that responding veterinarians have undergone. This could have been during school (table 3a) or after school (table 3b). Most have no formal training during or after school, during school 63% had no training and after school 44% had no training. If it did occur during school it involved 1-3 lectures (23%). After veterinary school, participants learned through reading on their own or being mentored 26% and 25% respectively. Table 3c asks whether or not there are euthanasia textbooks available in their practice for challenging cases. For example: “if multiple veins are blown, is there a reference guide to help in assisting of this?”. This question was followed by “Do you wish to comment on this?”. In table 3d it was shown that most respondents did not know a book like this existed (26%), or would like to own this book but do not (21%).

Table 3: Training of Veterinarians

a			b		
Have you had any formal training in euthanasia beyond cases seen during veterinary school?			Did you have any formal training in euthanasia after veterinary school?		
Answer	Count	%	Answer	Count	%
Core curriculum course	33	6%	Continuing education seminar	96	17%
1-3 Lectures	125	22%	I have read articles or books about euthanasia	145	26%
In a club	14	2%	Mentored guidance during an internship	138	25%
Externship	26	4%	Other	43	7%
Other	48	8%	None	239	44%
None	347	63%	Total	545	100%
Total	547	100%			

c			d		
Are there euthanasia textbooks available at your clinic for reference?			Do you wish to comment?		
Answer	Count	%	Answer	Count	%
Yes	90	17%	Didn't Know it Existed	17	26%
No	443	83%	Would like	14	21%
Total	533	100%	Online	8	12%
			Human Consult	12	18%
			Don't know whether it exists in clinic	15	23%
			Total	66	100%

Clinic Protocols

Table 4 discusses whether or not a specific protocol exists for the veterinarian. About half the time, 51%, the clinic will have established protocols (table 4a). Those protocols can be client centered (40%), technically based (35%), or a simple structure that can vary case to case (25%) (table 4b). Client centered protocols can involve paperwork, comfort rooms, mementos of the pet (paw print, fur tuft, urn, etc), or anything else to give comfort. Technically based protocols involve the sedation and euthanasia solution used on the pet.). Seventy percent answered that they do not wish to change their protocol, but if they do, 20% of the time it is to help their client (table 4c). Veterinarians can also have different protocols depending on whether they are euthanizing a dog or a cat, but 68% have the same protocol for a dog and a cat (table 4d).

Table 4: **Existence of Protocols**

a

Does your clinic have established euthanasia protocols that all staff follows for every appointment?		
Answer	Count	%
Yes	278	51%
No	262	49%
Total	540	100%

b

Do you wish to comment on having established protocols?		
Answer	Count	%
Client Centered Protocol	47	40%
Technical protocol	42	35%
Basic overall	30	25%
Total	119	100%

c

Would you change the protocol if you could, if so to what?		
Answer	Count	%
Client Change	18	20%
Want a better option (less sting)	3	3%
Open	7	8%
No	63	69%
Total	91	100%

d

When performing a Euthanasia do you use the same protocol for a dog and a cat?		
Answer	Count	%
Yes	369	68%
No	176	32%
Total	545	100%

Discussion with Client

The second part of the survey examines the particulars of a dog or cat euthanasia. Table 5 begins with asking whether or not the euthanasia process is discussed beforehand with the client. This can include the possibility of physical changes such as agonal breaths, eyes remaining open, body stretching or vocalization. This discussion almost always occurs (95%).

Table 5: **Discussion with Client**

	Is the euthanasia process discussed with the client beforehand?			
	Count		Percent	
	Dog	Cat	Dog	Cat
Yes	509	503	95%	95%
No	3	4	<1%	<1%
If time allows	25	23	5%	5%
Total	537	530	100%	100%

Injection Methods

Table 6 begins the technical process of injecting both the sedation (if used, table 7a) and euthanasia solution into the patient. The cephalic vein is most often used for both dogs and cats (61% for both) (table 6a). The next question is what method of injection is used (table 6b). Most respondents prefer a catheter (75%). If a catheter is used, the client is never allowed in the room 55% of the time for a dog and 58% of the time for a cat. Depending on circumstances, some veterinarians sometimes allow the client to stay with the pet. This occurs 39% of the time for a dog and 38% of the time for a cat (table 6c).

Table 6: Injection methods

a

	Which vein is typically used for the euthanasia solution?			
	Raw		Percent	
	Dog	Cat	Dog	Cat
Cephalic Vein	325	323	61%	61%
Lateral Saphenous Vein	146	86	27%	16%
Medial Saphenous Vein	3	37	>1%	7%
Other	62	83	12%	16%
Total	536	529	100%	100%

b

	Preferred method for injection			
	Raw Data		Percent	
	Dog	Cat	Dog	Cat
Intravenous Catheter	408	391	76%	75%
Butterfly Needle	85	75	16%	14%
Direct Venipuncture (Syringe and Needle)	44	59	8%	11%
Total	537	525	100%	100%

c

	Is the client present when the catheter is inserted?			
	Raw		Percent	
	Dog	Cat	Dog	Cat
Yes	25	16	6%	4%
No	224	225	55%	58%
Sometimes	159	149	39%	38%
Total	408	390	100%	100%

Sedation Medications

Some veterinarians do not use sedation ever, though this number is small at only 13% of respondents for dogs and 14% of respondents for cats. In 52% of cases sedation is always used (table 7), and the most common medication for sedation is propofol (Figure 2). If Telazol is used, it is normally in combination with other medications, because it can sting. Ketamine, Xylazine, and Acepromazine (Ace) are used in combination, and then another medication is added after, usually butorphanol or telazol (Figure 2).

Table 7: **Sedation use**

	Is any type of pre-euthanasia sedation used?			
	Count		Percent	
	Dog	Cat	Dog	Cat
Yes	286	276	54%	52%
No	71	73	13%	14%
Sometimes	179	180	33%	34%
Total	536	529	100%	100%

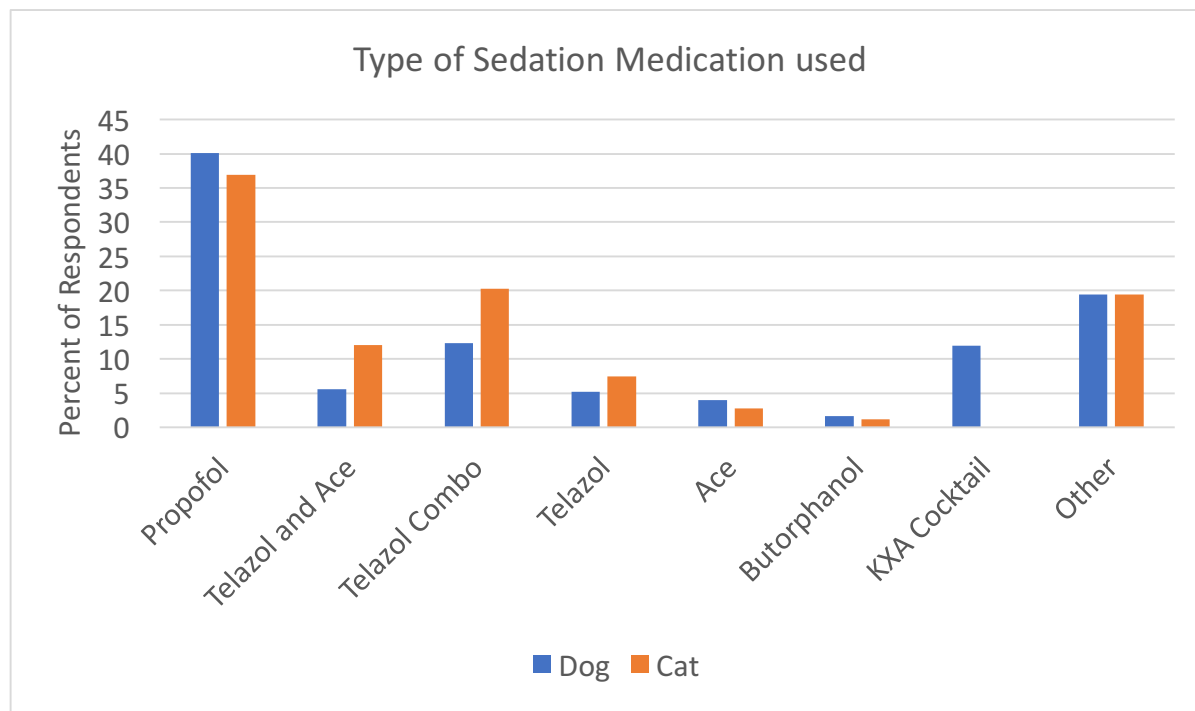


Figure 2: The standard sedation medications used on a dog and cat. Propofol is the most common for both cat and dog.

Euthanasia Medications

The final step of the euthanasia is to inject the euthanasia solution. In figure 3 cat and dog euthanasia medication use is compared. As shown in the figure, there is little difference in which euthanasia solution is used between species. The medications that are used to perform pet

euthanasia are listed below. The most common medication for both dog and cat euthanasia is euthasol (36% for both), followed by fatal plus (25% for both).

When calculating the results of this section, if a respondent put down two responses, the first response was taken. If they said “sodium pentobarbital” or “pentobarbital” their responses were filed under “Don’t Know”. Almost 10% of veterinarians do not know the brand name of the solution that they are giving the animals.

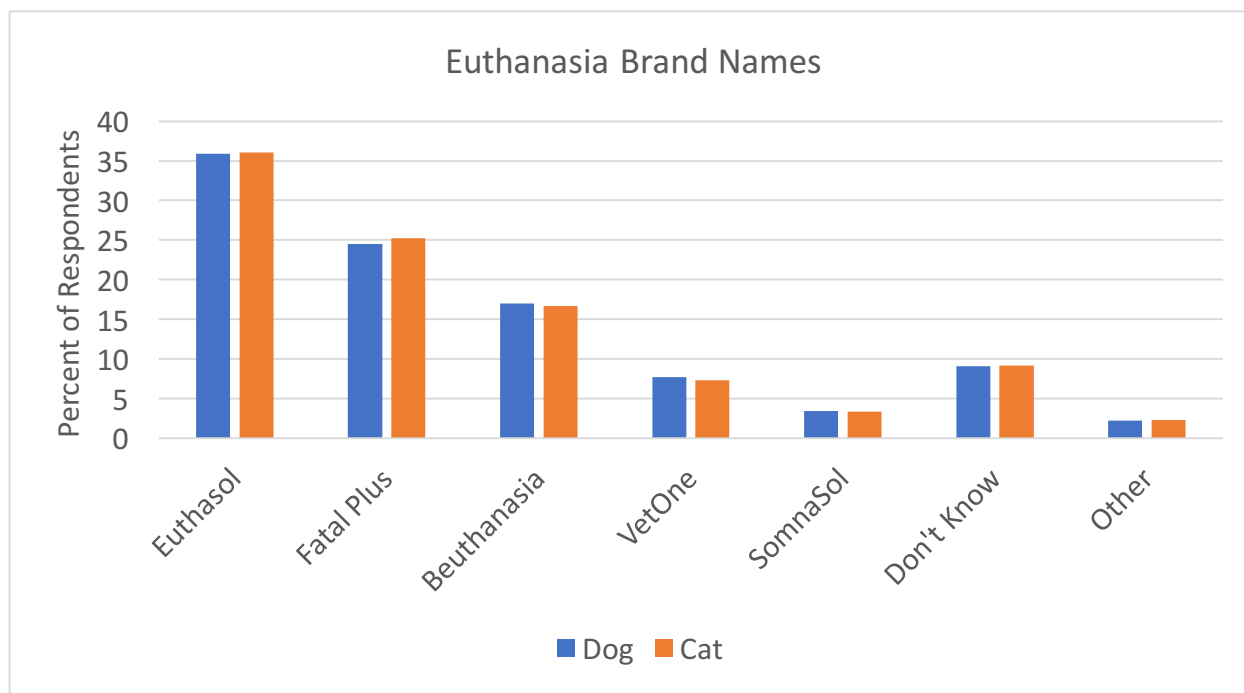


Figure 3: Euthanasia solutions for dog and cat. Euthasol is used most commonly and then fatal plus.

Changes in Euthanasia Practices Over Time

As seen in figure 4, from 1970 to 1999 86% of students had no formal euthanasia training in veterinary school (see table 3a for reference). Starting in 2000 that percentage dropped to 64%, and 2010 to 2016, the number lowered even further to 39% who have not had formal training in school. Figure 5 shows the preference for injection method versus graduation year. As graduation year has increased, the technique has changed toward use of a catheter rather than direct venipuncture. Figure 6 shows the correlation of graduation year and which respondents do home euthanasia. The graph shows that as graduation year increases, the number of respondents who perform euthanasia in home decreases. Figure 7 shows the differences in graduation year and whether or not clinic manuals are available for reference in the clinic. As graduation year increases the availability of the textbooks directly decreases.

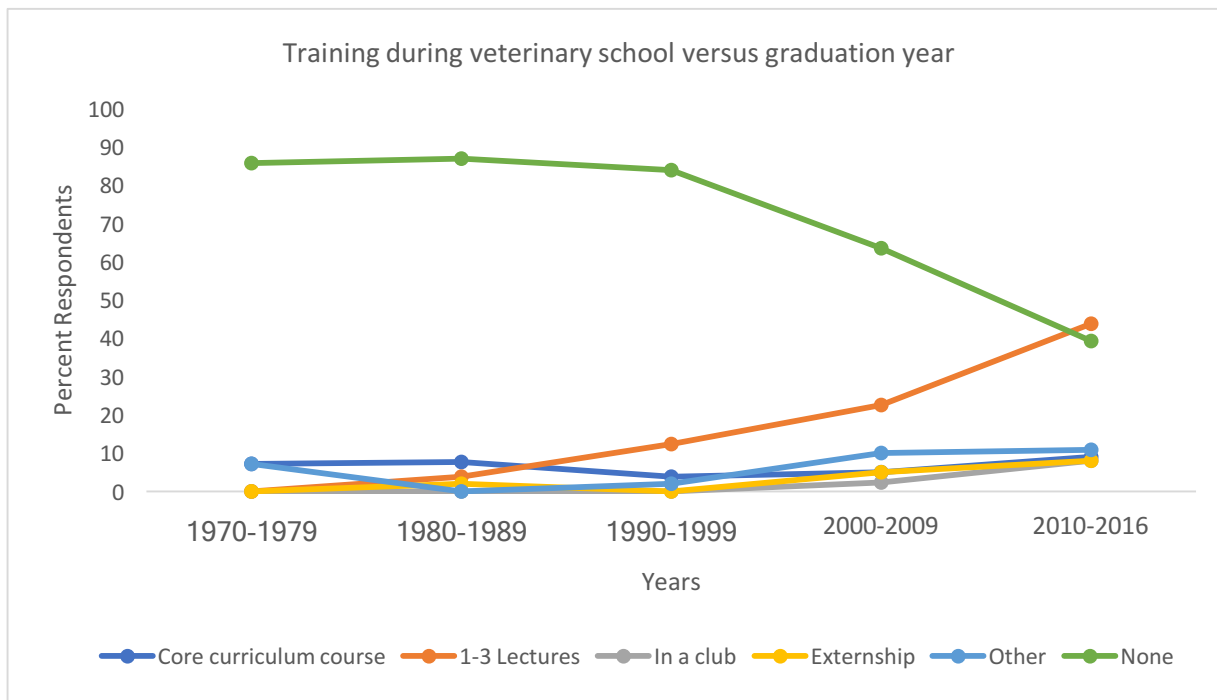


Figure 4: Training during veterinary school. Formal euthanasia training has increased over the years.

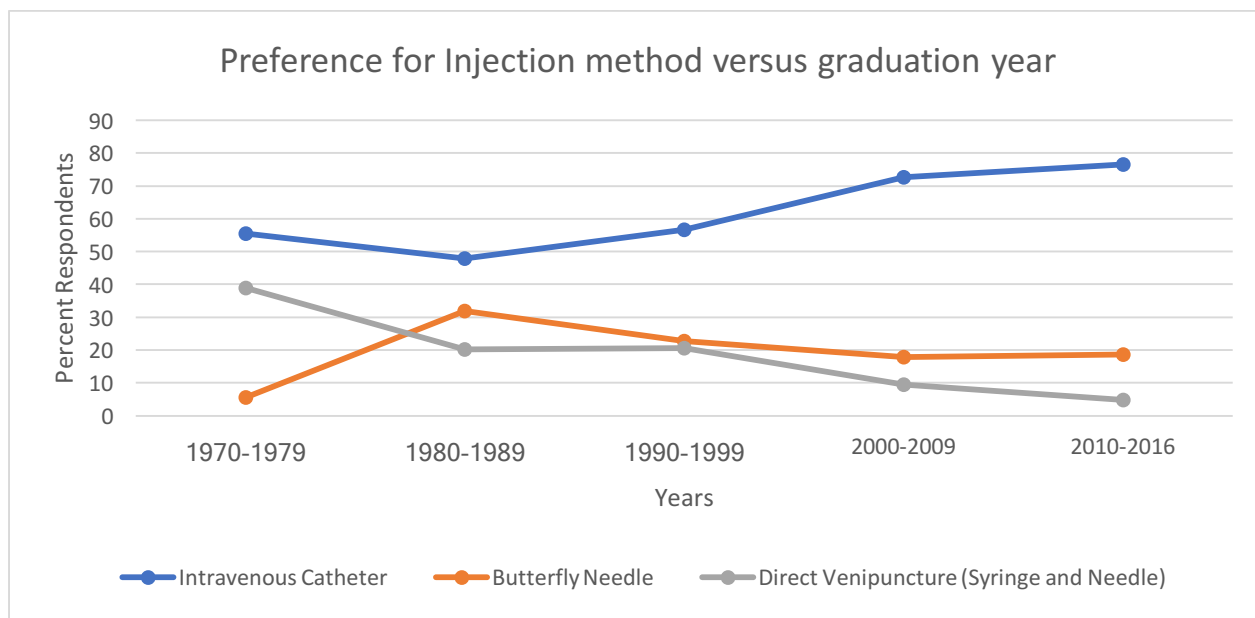


Figure 5: Preference for injection method versus graduation year. Intravenous catheter use and training has increased over the years.

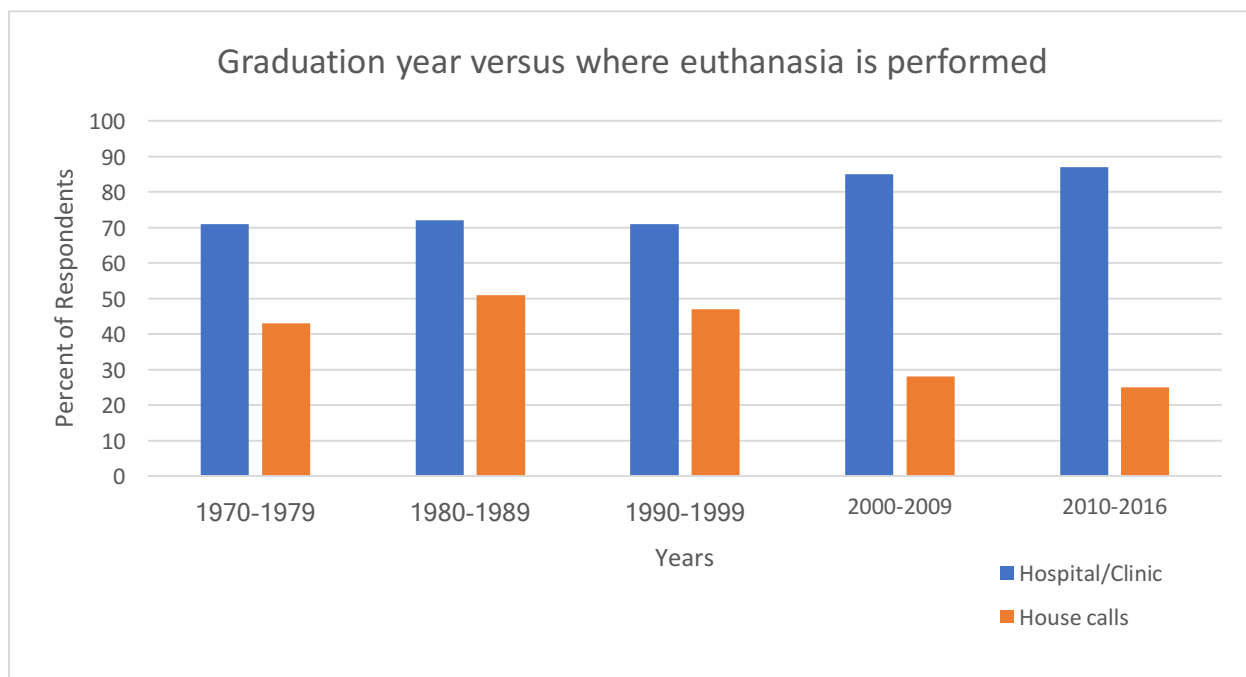


Figure 6: Where euthanasia is performed versus graduation year. House calls are less frequent in the graduation years after 2000. "Other" was also a recorded response, it was not shown as it was 5 respondents or 3.5%.

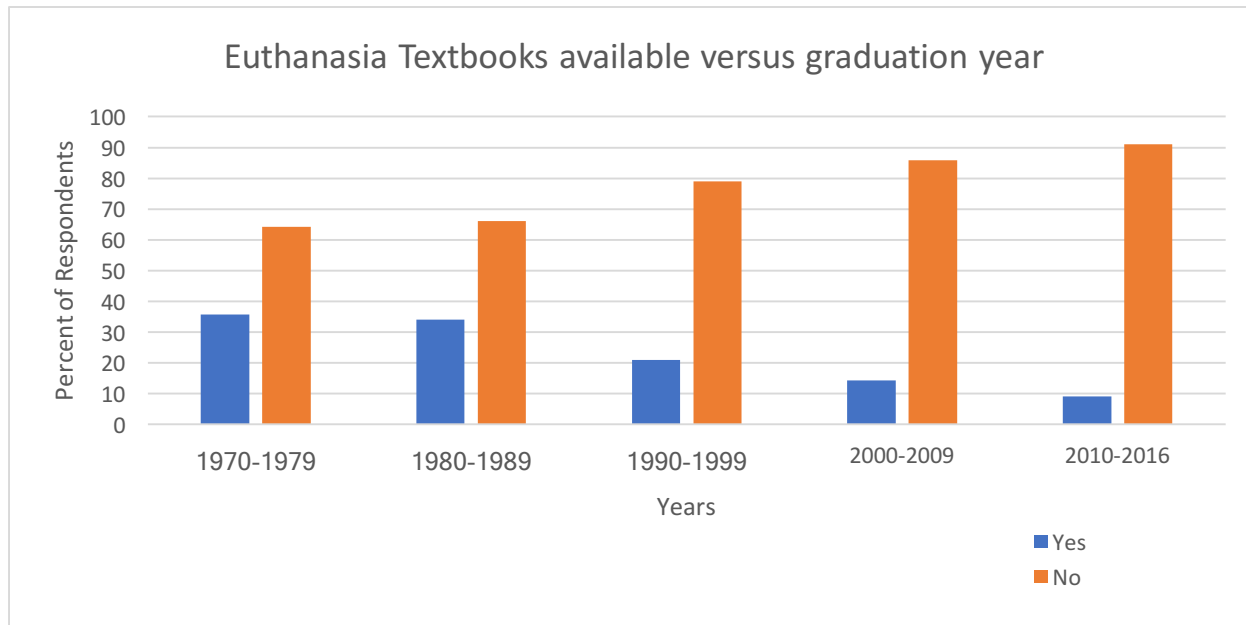


Figure 7: Euthanasia textbook availability in clinic versus graduation year. As graduation year increases, clinic textbook availability decreases.

Discussion

Veterinarians perform euthanasia extremely often in their career. It is not unusual for someone 5 years out of veterinary school to have performed anywhere between 100 to 500 euthanasias. With such a high demand, it is necessary for veterinarians to complete the process well, in order to please the client, ease the patient's suffering, and to ensure their own emotional well-being.

Demographics

Our survey respondents were 80% female, while in the veterinary industry approximately 60% are female. This difference can be accounted for due to the tendency for male veterinarians to work in large animal care, while this survey only pertained to small animals (American Veterinary Medical Association, 2016). The largest portion of respondents were ages 31-40. The average age of veterinarians is 43 years. This is especially relevant because the average female veterinarian age is 39, while the average male age is 49 (ACS, n.d.). The highest numbers of respondents answered from Washington, California, Colorado, Wisconsin, Massachusetts, and Florida. When taken into account that the survey was distributed from Massachusetts and Colorado, the distribution of respondents matches up with the distribution of veterinarians in the US (Bureau of Labor Statistics, 2017).

Euthanasia Medications

The responses to the euthanasia medication questions bring up many interesting results when researched further. It was found that Euthasol is used 36% of the time, and Fatal Plus is used 25% of the time (Appendix B: Q33, Q45, Q57). The first interesting note about this is that most of the medications have no difference in active ingredients. Between Euthasol (Virbac, n.d.), Beuthanasia (Merck, n.d.), VetOne (VetOne, n.d.), and SomnaSol (Henry Schlein, n.d.), all of these medications contain 390 mg/mL sodium pentobarbital and 50 mg/mL of phenytoin sodium. Additionally, they do not differ greatly in inactive ingredients. Fatal Plus is the only medication that differs, as it contains only 390mg/mL of sodium pentobarbital. It does not contain phenytoin sodium, which is an anti-seizure medication. Fatal Plus is also different because it is not approved by the FDA (FDA, 2017). Fatal Plus can still be marketed, but the FDA frowns upon this practice (FDA, 2016). This is most likely because sodium pentobarbital can create a high if injected in humans (US National Library of Medicine, 2012), and the addition of phenytoin sodium negates this concern.

Almost 10% of veterinarians do not know the brand of medication that they use to perform euthanasia (Figure 2). Respondents stated that either a technician draws it up for them, or they have never bothered to read the label. Most only know what color the solution is, but with most of the solutions being pink and only fatal plus being blue, this was not specific enough for researchers to identify the medication. While this is concerning, it should be noted that most of the medications contain the same active ingredients, so not knowing the brand name of the medication is understandable.

In addition, Beuthasol was listed in the survey 23 times out of 490 respondents. This is interesting, as this brand of medication does not actually exist (Sherill et al., 2001). Authors attempted to research this issue, and while Beuthasol has been used in IRB approved documents and other studies, no information on the active or inactive ingredients can be found. In one of the

papers a laboratory was listed. A call was made to the manufacturers by the authors, and the manufacturers said that the medication has never been called “Beuthasol”, but rather is the medication Euthasol. Beuthasol was most likely a typo that was propagated.

Change in Euthanasia Practices over Time

As was shown in results, euthanasia education has increased over time, as it has become more important to veterinary practices. While the results of this data are not statistically significant (p -value 0.28), a trend is still evident. This is likely because there has been a shift in America to pets being considered part of the family, and because of this a proper euthanasia is necessary for the pet owner to feel like euthanasia was the right decision (Wooten, 2016). More courses in the euthanasia process allows veterinarians to feel more prepared both technically and emotionally when they enter practices.

IV Catheter usage has also increased over time, indicating that graduation year is associated with technique. While the results of this data are not statistically significant (p -value 0.12), it does show a trend. This is most likely because IV catheters became mass producible in 1974 (Rivera et al., 2005). After this time, the technology would have taken some years to become integrated into the veterinary world. Using a catheter is now preferable, as it allows the veterinarian to know that when it is time to inject the sedation and euthanasia solution, they will not struggle with finding a vein or having an error in front of the client.

Home euthanasia practice shows a negative trend (p -value 0.44) when compared to graduation year (Figure 6). This means recent graduates are not performing home euthanasias, whereas older veterinarians are. This could be because the recent students have loans to pay off, and thus they do not have the time, or their own practices, to be able to perform this task. As shown in table 2e, 20% of the respondents said that they were not staffed to perform home euthanasias.

When examining if there were textbooks or not in the clinic, 83% of the respondents answered that there were not (Table 3c). The most common reason for why the clinic did not was because 26% didn’t know that it existed, which it does, Kathleen Cooney’s book is an example. But when examined by graduation year, it was found that euthanasia textbooks are more available in clinics where the respondents were older (figure 7). While the results of this data are not statistically significant (p -value 0.56), there appears to be a trend. A possible explanation is that in the digital age, the more recent graduates are comfortable having their textbooks online, and thus no hard copies are available to them.

Other data analysis was performed to see if there were correlations between graduation year and responses. All questions involved in protocol (client discussion, vein used, method of injection, client present for catheter injection, and whether sedation is used) other than method of injection had no correlations between graduation year and the responses seen. Home euthanasia and protocols were also analyzed: where a respondent performed euthanasia, whether the hospital performs euthanasia, whether a referral to home euthanasia was given, if there was a specific comfort room, whether there are specific protocols, and whether a euthanasia textbook was available. As stated previously, only the availability of the euthanasia textbook showed a correlation.

Limitations

The limitations to this study include: to whom we sent the survey, the questions asked, and the open response boxes. The survey was sent to emergency and specialty care hospitals, and thus we received responses from emergency and critical care hospitals, this could have biased the results.

To alleviate this concern in a future study it should be asked what type of practitioner the veterinarian is: general, specialty, emergency, academic, etc.

Due to the initial design of the survey, the data were difficult to analyze. In the survey, “both” was an available option in some questions. This made extra work when analyzing the data, as the “both” responses had to be added to the individual options. In future, rather than saying “both”, there instead should be the option to multiple select. This would allow the respondents to select however many options they use, while making the data easy to analyze. Another limitation of the survey was that the protocol portion of the survey was split into three sections. The first section discussed protocols used for both dogs and cats, while the second and third sections were specific to dog or cat respectively. This presented a problem, as it seemed respondents did not remember what animal they were answering questions about. For example, in the “dog section”, under sedations, it was frequent to see both animals listed with their respective medications. It is unknown whether or not any other areas of the survey were affected in a similar way, as most did not have open response boxes. Another complication with data analysis was the use of the “open-text” format, where respondents could write what they wished in the box. This led to misspellings of various euthanasia medications, as well as difficulties analyzing pre-euthanasia medications, and caused researchers to devote much of their time to analyzing this data. In future, this format should be changed to a selectable method where various choices are given, with a response box for “other”.

References

- American Veterinary Medical Association. (2016). Market research statistics: US veterinarians, 2016.
- ACS. (n.d.). Veterinarians. Retrieved April 23, 2017, from <https://datausa.io/profile/soc/291131/#demographics>
- Bureau of Labor Statistics. (2017, March 31). Occupational Employment and Wages, May 2016: Veterinarians. Retrieved April 23, 2017, from <https://www.bls.gov/oes/current/oes291131.htm#st>
- Cooney, K. A., Chappell, J. R., Callan, R. J., & Connally, B. A. (2012). Equipment. *Veterinary euthanasia techniques: a practical guide* (19-43). Ames, Iowa: Wiley-Blackwell.
- Cooney, K. A., Chappell, J. R., Callan, R. J., & Connally, B. A. (2012). Euthanasia Techniques. *Veterinary euthanasia techniques: a practical guide* (73-169). Ames, Iowa: Wiley-Blackwell.
- Cooney, K. A., Chappell, J. R., Callan, R. J., & Connally, B. A. (2012). Introduction. *Veterinary euthanasia techniques: a practical guide* (xi-xiv). Ames, Iowa: Wiley-Blackwell.
- Cooney, K. A., Chappell, J. R., Callan, R. J., & Connally, B. A. (2012). Positioning and Restraint. *Veterinary euthanasia techniques: a practical guide* (43-51). Ames, Iowa: Wiley-Blackwell.
- Cooney, K. A., Chappell, J. R., Callan, R. J., & Connally, B. A. (2012). Pre-euthanasia Sedation and Anesthesia. *Veterinary euthanasia techniques: a practical guide* (51-72). Ames, Iowa: Wiley-Blackwell.
- Dugdale, A., & Ebrary Academic Complete. (2010;2011;). *Veterinary anaesthesia: Principles to practice* (1. Aufl.;1; ed.). Ames, Iowa;Chichester, West Sussex;: Blackwell Pub.
- FDA. (2017, January). Section 2.0 - Active Ingredients. Retrieved April 23, 2017, from <https://www.fda.gov/downloads/AnimalVeterinary/Products/ApprovedAnimalDrugProducts/UCM042860.pdf>
- FDA. (2016, April 18). Unapproved Animal Drugs - FDA's Concerns about Unapproved Animal Drugs. Retrieved April 23, 2017, from <https://www.fda.gov/AnimalVeterinary/GuidanceComplianceEnforcement/ComplianceEnforcement/UnapprovedAnimalDrugs/ucm229084.htm>
- Fernandez-Mehler, P., Gloor, P., Sager, E., Lewis, F. I., & Glaus, T. M. (2013). Veterinarians' role for pet owners facing pet loss. *Veterinary Record*, 172(21), 555-555.
- HENRY SCHEIN. (n.d.). SomnaSol for Animal Use. Retrieved April 23, 2017, from <https://www.drugs.com/vet/somnasol.html>
- Leary, S., Underwood, W., Anthony, R., Cartner, S., Corey, D., Grandin, T., ... & Miller, D. (2013). AVMA guidelines for the euthanasia of animals: 2013 edition.
- Martin, F., Ruby, K. L., Deking, T. M., & Taunton, A. E. (2004). Factors associated with client, staff, and student satisfaction regarding small animal euthanasia procedures at a veterinary teaching hospital. *Journal of the American Veterinary Medical Association*, 224(11), 1774-1779.
- Merck. (n.d.). Beuthanasia-D Special. Retrieved April 23, 2017, from <https://www.drugs.com/vet/beuthanasia-d-special.html>
- Morris, P. (2012). Creating a Good Death: The Dramaturgy of Veterinary Euthanasia. *Blue juice: euthanasia in veterinary medicine* (49-79). Temple University Press.
- Morris, P. (2012). Negotiating Death: Managing Disagreement with Pet Owners. *Blue juice: euthanasia in veterinary medicine* (19-48). Temple University Press.
- Rivera, A. M., Strauss, K. W., Van Zundert, A., & Mortier, E. (2005). The history of peripheral intravenous catheters: how little plastic tubes revolutionized medicine. *Acta Anaesthesiologica Belgica*, 56(3), 271.

- Scotney, R. L., McLaughlin, D., & Keates, H. L. (2015). A systematic review of the effects of euthanasia and occupational stress in personnel working with animals in animal shelters, veterinary clinics, and biomedical research facilities. *Journal of the American Veterinary Medical Association*, 247(10), 1121-1130.
- Sherrill, J., Ware, L. H., Lynch, W. E., Montali, R. J., & Bush, M. (2001). Contrast Radiography With Positive-Pressure Insufflation in Northern Pintails (*Anas acuta*). *Journal of Avian Medicine and Surgery*, 15(3), 178-186.
- US National Library of Medicine. (2012, May). Nembutal® Sodium Solution (pentobarbital sodium injection, USP). Retrieved April 23, 2017, from <https://dailymed.nlm.nih.gov/dailymed/archives/fdaDrugInfo.cfm?archiveid=80225>
- VetOne. (n.d.). Euthanasia Solution. Retrieved April 23, 2017, from <http://www.vetone.net/Default/CatHeaderPage/1b6b43fd-d6c4-4b43-a142-d2c44755cc11>
- Virbac. (n.d.). Euthasol Euthanasia Solution for Animal Use. Retrieved April 23, 2017, from <https://www.drugs.com/vet/euthasol-euthanasia-solution.html>
- Wooten, S. J. (2016, February 23). Before the end: Prepare highly attached clients to face their pets' death. Retrieved April 12, 2017, from <http://veterinarymedicine.dvm360.com/end-prepare-highly-attached-clients-face-their-pets-death>

Appendix

Appendix A: Original Survey

Q29 Thank you for participating in our survey. The information you fill out is key to our study of euthanasia practices. Please remember to take the survey after every euthanasia you perform. For more information on the study, please see INSERT WEBLINK.

Q28 Please fill in your identifier. Your identifier is: First initial of first name.number of older siblings at your birth.first letter of the town in which you were born

Q1 Is the patient a cat or a dog?

- Cat (1)
- Dog (2)
- Other (3)

If Other Is Selected, Then Skip To End of Survey

Q2 What age is this animal, in years?

- 0-1 (1)
- 2-4 (2)
- 5-7 (3)
- 8-10 (4)
- 11-13 (5)
- 14-16 (6)
- 17-19 (7)
- 20-22 (8)
- 23-25 (9)
- 26-28 (10)
- 29-30 (11)

Q4 How much does this animal weigh?

_____ In pounds (lbs) (1)

Q5 Does this animal have weakened veins?

- Yes (1)
- Maybe (2)
- No (3)

Q16 Was type of visit was this?

- Scheduled-with primary care veterinarian (1)
- Scheduled-with available veterinarian (7)
- Urgent-with primary care veterinarian (4)
- Urgent-with available veterinarian (2)
- ER visit-with available veterinarian (3)

If ER visit-with available vet... Is Selected, Then Skip To Was the client present for the euthan...

Q17 What was the location of the visit?

- Clinic (1)
- In the client's home (2)

Q13 Was the client present for the euthanasia?

- Yes (1)
- No (2)

Q18 Was one of the reasons for euthanasia financial based?

- Yes (1)
- No (2)

Q21 Were any of these types of pre-euthanasia medications used?

- Sedation (1)
- Pain Control (2)
- Anesthesia (3)
- None of the above (4)

Display This Question:

If Were any of these techniques used? Anesthesia Is Selected

Q23 Which specific drug was used for anesthesia?

- Propofol (1)
- Ketamine (2)
- Telazol (3)
- Isoflurane (4)
- Halothane (5)
- Sevoflurane (6)
- Other (7)

Display This Question:

If Were any of these techniques used? Sedation Is Selected

Q20 Which specific drug was used during sedation?

- Xylazine (1)
- Medetomidine (2)
- Butorphanol (3)
- Propofol (4)
- Ketamine (5)
- Telazol (6)
- Isoflurane (7)
- Halothane (8)
- Sevoflurane (9)
- Other (10)

Display This Question:

If Were any of these techniques used? Pain Control Is Selected

Q22 Which specific drug was used for pain control?

- Opioid (1)
- NSAID (2)
- Other (3)

Display This Question:

If Which specific drug was used for pain control? Opioid Is Selected

Q26 Which specific Opioid drug was used?

- Pethidine (1)
- Morphine (2)
- Methadone (3)
- Fentanyl (4)
- Alfentanil (5)
- Etorphine (6)
- Buprenorphine (7)
- Butorphanol (8)
- Naloxene (9)
- Other (10)

Display This Question:

If Which specific drug was used for pain control? NSAID Is Selected

Q27 Which specific NSAID was used?

- Carprofen (1)
- Metamizole (2)
- Meloxicam (3)
- Nimesulide (4)

Q27 What was the type of euthanasia solution used?

- Tributane (1)
- Sodium Pentobarbital (2)
- Carbon Monoxide (3)
- Other (4)

Q9 What was the estimated time between the administration of the euthanasia solution to time of death? (in minutes)

- 0:00-1:00 (1)
- 1:01-2:00 (2)
- 2:01-3:00 (3)
- 3:01-4:00 (4)
- 4:01-5:00 (5)
- 5:01-6:00 (6)
- 6:01-7:00 (7)
- 7:01-8:00 (8)
- 8:01-9:00 (9)
- 9:01-10:00 (10)

Q24 Was a catheter used?

- Yes (1)
- No (2)

Q26 Which type of syringe was used?

- Butterfly (1)
- Syringe and Needle (2)

Q8 Was there vocalization?

- Yes (1)
- No (2)

Q10 Were there agonal breaths?

- Yes (1)
- No (2)

Q33 What methods of restraint were used?

- Held by client (1)
- Held by coworker (2)
- Muzzle (3)
- Wrapped in cloth (4)

Q6 Estimate the difficulty with restraint of the patient?

- Extremely easy (1)
- Somewhat easy (2)
- Neither easy nor difficult (3)
- Somewhat difficult (4)
- Extremely difficult (5)

Q7 What were the possible reasons for the need of restraint for this patient?

- Pain (1)
- Anxiety (2)
- Aggression (3)
- Size (4)

Q11 What was the level of discomfort (evidenced as either pain or stress) experienced by the patient?

- A great deal (1)
- A lot (2)
- A moderate amount (3)
- A little (4)
- None at all (5)

Q12 Not including estimating client anguish over losing their pet, how do you think the euthanasia went from the client's perspective?

- Excellent (21)
- Good (22)
- Neither good nor poor (23)
- Poor (24)
- Terrible (25)

Q14 How would you rate the technical difficulty of the euthanasia?

- Extremely easy (1)
- Somewhat easy (2)
- Neither easy nor difficult (3)
- Somewhat difficult (4)
- Extremely difficult (5)

Q15 How much moral distress did this particular euthanasia cause you?

- A great deal (1)
- A lot (2)
- A moderate amount (3)
- A little (4)
- None at all (5)

Display This Question:

If From your perspective, how much moral distress did this particular euthanasia cause you? A great deal Is Selected

And From your perspective, how much moral distress did this particular euthanasia cause you? A lot Is Selected

And From your perspective, how much moral distress did this particular euthanasia cause you? A moderate amount Is Selected

And From your perspective, how much moral distress did this particular euthanasia cause you? A little Is Selected

And From your perspective, how much moral distress did this particular euthanasia cause you? None at all Is Selected

Q30 Why did this euthanasia cause you that level of moral distress?

Q28 How long did the procedure take from start to finish (from client arrival into procedure room to client departure from procedure room)?

_____ Minutes (1)

Q31 Is there anything else you'd like to tell us?

Appendix 1B: Protocol Survey

IRB approved-Demographics of the Veterinarian and their Euthanasia Protocol

Q1 Dear Colleague, Euthanasia is one of the significant challenges of a veterinary practitioner's work. We are fortunate to have several recent textbooks to guide us, but there is a critical need for research into factors that contribute positively or negatively to a satisfactory event. The purpose of this initial survey is to gather information on the techniques you utilize and the training and resources available to you for feline and canine patients. This information can then be used to support veterinarians in the U.S. Procedure: If you consent to participate, this survey takes approximately 10 to 15 minutes to complete. Following this, if you are willing to follow up with a study on specific experiences with your patients, you will be directed to a link for a short event survey that you can complete after you perform euthanasia on your patients. Risks and discomforts: You may experience an emotional reaction to reviewing and reporting your opinions about a euthanasia. Confidentiality: No information to identify you or your practice will be collected. At the end of this survey you will build a 3 character code, this will be used to pair your event surveys to your demographic information. You will also be invited to enter your email address to participate in a raffle for a euthanasia textbook (this is voluntary). Your email address is collected in a separate location and cannot be associated with your survey responses. Withdrawal of participation: Your participation is voluntary and you may decide at any time that you no longer wish to participate. You may decline to answer any question. Please contact the Principal Investigator if you have questions or concerns, or Lara Sloboda at the Office of the Institutional Review Board at (617) 627-3417. The author of this study is:· Alicia Karas DVM DACVAA, Principal Investigator, anesthesiologist at Cummings School of Veterinary Medicine, Tufts University, North Grafton, MA 01536 alicia.karas@tufts.edu· Kathleen Cooney DVM, Consultant, internationally recognized author and expert in hospice and euthanasia, founder of Home to Heaven, principal of Cooney Animal Hospice Consulting· Julia Holtzman, Worcester Polytechnic Institute, Senior in pursuit of a undergraduate degree in Biology/Biotechnology· Evelyn Platko, Worcester Polytechnic Institute, Senior in pursuit of a undergraduate degree in Biology/Biotechnology. Pursuing Veterinary School.

Q2 I have read and understood the purpose of this study and my rights as an informed participant. I wish to continue with the survey

- Yes (1)
- No (2)

If No Is Selected, Then Skip To End of Survey

Q3 Thank you for agreeing to be a part of our study! This is an initial one-time survey to gather information about your typical euthanasia techniques. After filling this out, you can choose to continue to participate in the second phase: a study designed to help us understand the impact that the euthanasia setting, drugs, patient status and other factors had on the quality of the euthanasia. You may bookmark a link to take this second survey every time you perform a euthanasia, or when a special case comes up. This second survey focuses on the technical and the emotional aspects of each particular euthanasia. Thank you again!

Q4 Age

- 20-30 (1)
- 31-40 (2)
- 41-50 (3)
- 51-60 (4)
- 61-70 (5)
- Prefer not to say (6)

Q5 Gender

- Male (1)
- Female (2)
- Prefer not to say (3)

Q6 Are you a technician who is able to perform euthanasia in your state, or a doctor of veterinary medicine?

- Doctor of veterinary medicine (1)
- Technician (2)
- Other (3)

If Other Is Selected, Then Skip To End of Survey

Display This Question:

If Are you a technician or a doctor of veterinary medicine? Doctor of Veterinary medicine Is Selected

Q7 Year of graduation from veterinary school

- 1960 (1)
- 1961 (2)
- 1962 (3)
- 1963 (4)
- 1964 (5)
- 1965 (6)
- 1966 (7)
- 1967 (8)
- 1968 (9)
- 1969 (10)
- 1970 (11)
- 1971 (12)
- 1972 (13)
- 1973 (14)
- 1974 (15)
- 1975 (16)
- 1976 (17)
- 1977 (18)
- 1978 (19)
- 1979 (20)
- 1980 (21)
- 1981 (22)
- 1982 (23)
- 1983 (24)
- 1984 (25)
- 1985 (26)
- 1986 (27)
- 1987 (28)
- 1988 (29)
- 1989 (30)
- 1990 (31)
- 1991 (32)
- 1992 (33)
- 1993 (34)
- 1994 (35)
- 1995 (36)
- 1996 (37)
- 1997 (38)

- 1998 (39)
- 1999 (40)
- 2000 (41)
- 2001 (42)
- 2002 (43)
- 2003 (44)
- 2004 (45)
- 2005 (46)
- 2006 (47)
- 2007 (48)
- 2008 (49)
- 2009 (50)
- 2010 (51)
- 2011 (52)
- 2012 (53)
- 2013 (54)
- 2014 (55)
- 2015 (56)
- 2016 (57)
- 2017 (58)

Q8 Is your practice in the continental U.S.?

- Yes (1)
- No (2)

If No Is Selected, Then Skip To End of Survey

Q9 State of practice

- AL (1)
- AK (2)
- AZ (3)
- AR (4)
- CA (5)
- CO (6)
- CT (7)
- DE (8)
- FL (9)
- GA (10)
- HI (11)
- ID (12)
- IL (13)
- IN (14)
- IA (15)
- KS (16)
- KY (17)
- LA (18)
- ME (19)
- MD (20)
- MA (21)
- MI (22)
- MN (23)
- MS (24)
- MO (25)
- MT (26)
- NE (27)
- NV (28)
- NH (29)
- NJ (30)
- NM (31)
- NY (32)
- NC (33)
- ND (34)
- OH (35)
- OK (36)
- OR (37)
- PA (38)
- RI (39)
- SC (40)
- SD (41)

- TN (42)
- TX (43)
- UT (44)
- VT (45)
- VA (46)
- WA (47)
- WV (48)
- WI (49)
- WY (50)

Q10 Where do you perform euthanasia?

- Hospital/Clinic (1)
- House calls (2)
- Both (3)
- Other (4) _____

Q11 Does your hospital routinely offer home euthanasia appointments?

- Yes (1)
- No (2)
- For special individual cases (3)
- As a major part of my practice (4)

Display This Question:

If Does your hospital routinely offer home euthanasia appointments? No Is Selected

Q12 Do you wish to say why it does not?

Q13 Do you refer your clients to a home euthanasia service?

- Yes (1)
- No (2)
- Sometimes (3) _____

Display This Question:

If Do you work out of a clinic, or make house calls? Clinic Is Selected

Or Do you work out of a clinic, or make house calls? both Is Selected

Q14 Is there a specific euthanasia comfort room in your clinic?

- Yes (1)
- No (2)

Q15 Did you have any formal training during veterinary school in euthanasia beyond exposure to it via clinic cases?

- Core curriculum course (1)
- 1-3 Lectures (2)
- In a club (3)
- Externship (4)
- Other (5) _____
- None (6)

Q16 Did you have any formal training in euthanasia after veterinary school?

- Continuing education seminar (1)
- I have read articles or books about euthanasia (6)
- Mentored guidance during an internship (2)
- Other (4) _____
- None (5)

Q17 Does your clinic have established euthanasia protocols that all staff follows for every appointment?

- Yes (1)
- No (2)

Q18 Do you wish to comment on this?

Display This Question:

If Does your clinic have established euthanasia protocols all staff follows for every appointment?

Yes Is Selected

Q19 Would you change the protocol if you could, if so to what?

Q20 Does your practice have euthanasia technique books available for staff to refer to, especially if challenging situations present?

- Yes (1)
- No (2)

Q21 Do you wish to comment on this?

Q22 At the time of the survey how many euthanasias do you believe you have performed?

- 0-100 (1)
- 101-500 (2)
- 501-1000 (3)
- Over 1000 (4)

Q23 When performing a Euthanasia (including both pre-euthanasia and euthanasia) do you use the same protocol for a dog and a cat?

- Yes (1)
- No (2)

Q24 The following questions pertain to your typical protocol for both dog and cat euthanasia (including both pre-euthanasia and euthanasia) .

Q25 Is the euthanasia process discussed with the client beforehand, including possible physical changes such as: agonal breaths, eyes remaining open, body stretching, or vocalization?

- Yes (1)
- No (2)
- If time allows (3)

Q26 Do you wish to comment on this?

Q27 Is any type of pre-euthanasia sedation by oral, subcutaneous, or intramuscular routes used?

- Yes (1)
- No (2)
- Sometimes (3)

Display This Question:

If Are pre-euthanasia sedation by oral, subcutaneous, or intramuscular route used? Yes Is Selected

Q28 Which medication or combination of medication are used for sedation?

Q29 Which is you preferred method for injection of euthanasia solution?

- Intravenous Catheter (1)
- Butterfly Needle (2)
- Direct Venipuncture (Syringe and Needle) (3)

Display This Question:

If Which is you preferred method for injection of euthanasia solution? Intravenous Catheter Is Selected

Q30 Is the client present when the catheter is inserted?

- Yes (1)
- No (2)
- Sometimes (3)

Q31 Which vein is typically used for the euthanasia solution injection?

- Cephalic Vein (1)
- Lateral Saphenous Vein (2)
- Medial Saphenous Vein (3)
- Other (4) _____

Q32 Which other routes of injection have you used for administering euthanasia solution?

- Intraperitoneal (2)
- Intrahepatic (3)
- Intrarenal (4)
- Intracardiac (5)
- Other (6) _____

Q33 What is the specific type of euthanasia solution used (medication name and if possible brand)?

Q34 Optional: Why do you use this particular solution?

Q35 Is there anything else you'd like to tell us about your euthanasia protocol or procedures?

Q36 The following questions pertain to your typical protocol for dog euthanasia (including both pre-euthanasia and euthanasia) .

Q37 Is the euthanasia process discussed with the client beforehand, including possible physical changes such as: agonal breaths, eyes remaining open, body stretching, or vocalization?

- Yes (1)
- No (2)
- If time allows (3)

Q38 Do you wish to comment on this?

Q39 Is any type of pre-euthanasia sedation by oral, subcutaneous, or intramuscular routes used?

- Yes (1)
- No (2)
- Sometimes (3)

Display This Question:

If Are pre-euthanasia sedation by oral, subcutaneous, or intramuscular route used? Yes Is Selected

Q40 Which medication or combination of medication are used for sedation?

Q41 Which is your preferred method for injection of euthanasia solution?

- Intravenous Catheter (1)
- Butterfly Needle (2)
- Direct Venipuncture (Syringe and Needle) (3)

Display This Question:

If Which is you preferred method for injection of euthanasia solution? Intravenous Catheter Is Selected

Q42 Is the client present when the catheter is inserted?

- Yes (1)
- No (2)
- Sometimes (3)

Q43 Which vein is typically used for the euthanasia solution injection?

- Cephalic Vein (1)
- Lateral Saphenous Vein (2)
- Medial Saphenous Vein (3)
- Other (4) _____

Q44 Which other routes of injection have you used for administering euthanasia solution?

- Intraperitoneal (2)
- Intrahepatic (3)
- Intrarenal (4)
- Intracardiac (5)
- Other (6) _____

Q45 What is the specific type of euthanasia solution used (medication name and if possible brand)?

Q46 Optional: Why do you use this particular solution?

Q47 Is there anything else you'd like to tell us about your euthanasia protocol or procedures?

Q48 The following questions pertain to your typical protocol for cat euthanasia (including both pre-euthanasia and euthanasia) .

Q49 Is the euthanasia process discussed with the client beforehand, including possible physical changes such as: agonal breaths, eyes remaining open, body stretching, or vocalization?

- Yes (1)
- No (2)
- If time allows (3)

Q50 Do you wish to comment on this?

Q51 Is any type of pre-euthanasia sedation by oral, subcutaneous, or intramuscular routes used?

- Yes (1)
- No (2)
- Sometimes (3)

Display This Question:

If Are pre-euthanasia sedation by oral, subcutaneous, or intramuscular route used? Yes Is Selected

Q52 Which medication or combination of medication are used for sedation?

Q53 Which is your preferred method for injection of euthanasia solution?

- Intravenous Catheter (1)
- Butterfly Needle (2)
- Direct Venipuncture (Syringe and Needle) (3)

Display This Question:

If Which is your preferred method for injection of euthanasia solution? Intravenous Catheter Is Selected

Q54 Is the client present when the catheter is inserted?

- Yes (1)
- No (2)
- Sometimes (3)

Q55 Which vein is typically used for the euthanasia solution injection?

- Cephalic Vein (1)
- Lateral Saphenous Vein (2)
- Medial Saphenous Vein (3)
- Other (4) _____

Q56 Which other routes of injection have you used for administering euthanasia solution?

- Intraperitoneal (2)
- Intrahepatic (3)
- Intrarenal (4)
- Intracardiac (5)
- Other (6) _____

Q57 What is the specific type of euthanasia solution used (medication name and if possible brand)?

Q58 Optional: Why do you use this particular solution?

Q59 Is there anything else you'd like to tell us about your euthanasia protocol or procedures?

Q60 We are grateful for your participation! The second phase of our study is to examine how various factors affect the individual experience of euthanasia – how it was for the patient, the caregiver, and for you and your staff. There is a second survey that can be taken after each and every euthanasia you perform over the next 12 months. It is meant to capture unique information from individual cases to contribute to an understanding of factors that affect the

experience. The link to this survey can be bookmarked on your computer or smartphone for easy access. The link can be found before you leave the survey.

Q61 If you plan to take the second survey, please make a confidential identifier. The purpose of this identifier is to link your surveys back to your demographics and protocol. It will be: First initial of first name.number of older siblings at your birth.first letter of the town in which you were born. Please enter this below for our record keeping.

Q62 Here is the link to the second survey:

https://tufts.qualtrics.com/SE/?SID=SV_doR9m7wfdZ4liXX To be able to access it once this survey is done please either right click and open in a new tab if you're on a computer. If you're on a smart phone hold down the link until the option appears to open in a new tab. Thank you!

Appendix 2B: Emotional Response Survey

IRB approved-Technical + Emotional Special Case

Q1 This is a survey that can be taken after each and any individual euthanasia you perform during the next 12 months. It should take approximately 10 to 15 minutes. It is meant to capture unique information from individual cases to contribute to an understanding of factors that affect the experience. For more information on the study, please see sites.tufts.edu/peteuthanasiastudy. To be able to find this survey easily, please bookmark this page on your smartphone or computer.

Q2 Please fill in your identifier. Your identifier is: First initial of first name.number of older siblings at your birth.first letter of the town in which you were born

Q3 Was this patient a cat or a dog?

- Cat (1)
- Dog (2)
- Other (3)

If Other Is Selected, Then Skip To End of Survey

Q4 Approximate age of patient, in years?

_____ Age (1)

Q5 Approximate weight of patient, in pounds (Lbs)?

_____ Weight (1)

Q6 Did you ever care for this patient prior to the euthanasia visit?

- Yes (1)
- No (2)

Q7 Was this euthanasia recommended by a veterinarian or requested by the client?

- Veterinarian (1)
- Client (2)
- Other (3) _____

Q8 Was type of visit was this?

- Scheduled (1)
- Urgent (2)
- Emergency Room (3)

If Emergency Room Is Selected, Then Skip To Was the client present for the euthan...

Display This Question:

If Was type of visit was this? Scheduled Is Selected

Q9 Did the scheduling of this euthanasia cause a challenge due to time constraints?

- Yes (1)
- No (2)

Display This Question:

If Did the scheduling of the euthanasia cause a challenge due to time constraints?&nbsp;Yes Is Selected

Q10 Optional: Please comment if you are able

Q11 What was the location of the visit?

- Clinic (1)
- In the client's home (2)
- Other (3) _____

Q12 Was the client present for the euthanasia?

- Yes (1)
- No (2)
- Other (3) _____

Display This Question:

If Was the client present for the euthanasia? No Is Selected

Q13 What was the reason that the client wasn't present?

- Not allowed (1)
- Too emotional (2)
- Previous bad experience (3)
- Other (4) _____

Q14 Was the patient difficult to handle prior to sedation or during the euthanasia process?

- Yes (1)
- No (2)

If No Is Selected, Then Skip To Was pre-euthanasia sedation by oral, ...

Q15 What were the possible reasons for the need of restraint for this patient? (Please select all that apply)

- Pain (1)
- Anxiety (2)
- Aggression (3)
- Size (4)

Q16 What methods of restraint were used (if any)? (Please select all that apply)

- Held by client (1)
- Held by coworker (2)
- Muzzle (3)
- Wrapped in towel/blanket (4)
- Gloves (5)
- Other (6) _____

Q17 Was pre-euthanasia sedation by oral, subcutaneous, or intramuscular routes used?

- Yes (1)
- No (2)

Display This Question:

If Was pre-euthanasia sedation by oral, subcutaneous, or intramuscular routes used? Yes Is Selected

Q18 Which route was used for pre-euthanasia sedation?

- Oral (1)
- Subcutaneous (2)
- Intramuscular (3)
- Other (4) _____

Display This Question:

If Was pre-euthanasia sedation by oral, subcutaneous, or intramuscular routes used? Yes Is Selected

Q19 Which medication or combination of medication were used for sedation?

Q20 Did the pet unexpectedly die after sedation?

- Yes (1)
- No (2)

If Yes Is Selected, Then Skip To How would you rate the technical diff...

Q21 Were the client and pet together for the entire process?

- Yes (1)
- No (2)

Display This Question:

If Was the client and pet together for the entire process? No Is Selected

Q22 Why not?

Q23 Which route of injection was used for the euthanasia solution?

- Intravenous (1)
- Intraperitoneal (2)
- Intrahepatic (3)
- Intrarenal (4)
- Intracardiac (5)
- Other (6) _____

Display This Question:

If Which route of injection was used for the euthanasia solution? Intravenous Is Selected

Q24 Which type of access was used for the intravenous injection of euthanasia solution?

- IV Catheter (1)
- Butterfly Needle (2)
- Direct Venipuncture (Syringe and Needle) (3)

Display This Question:

If Which route of injection was used for the euthanasia medication? Intravenous Is Selected

Q25 Which vein was used for the euthanasia medication?

- Cephalic Vein (1)
- Lateral Saphenous Vein (2)
- Medial Saphenous Vein (3)
- Other (4) _____

Q26 What was the specific euthanasia solution used?

Q27 How would you rate the technical difficulty of the euthanasia for you and your staff?

- Extremely easy (1)
- Somewhat easy (2)
- Neither easy nor difficult (3)
- Somewhat difficult (4)
- Extremely difficult (5)

Q28 Optional: Is there anything else you'd like to tell us about the technical aspects of this particular euthanasia?

Q29 Was one of the reasons for euthanasia based on cost of continuing care?

- Yes (1)
- No (2)
- In part (3)

Q30 Was the euthanasia process discussed with the client beforehand, including possible physical changes such as: agonal breaths, eyes remaining open, body stretching, or vocalization?

- Yes (1)
- No (2)

Q31 Did vocalization occur at any time during the process?

- Yes (1)
- No (2)

Q32 Did agonal breaths occur?

- Yes (1)
- No (2)

Q33 Was the time between giving euthanasia solution and death acceptable to you?

- Yes (1)
- No (2)

Q34 Optional: What occurred to cause this opinion?

Q35 Your estimation of the level of patient's discomfort during the process?

- None at all (1)
- Little discomfort (2)
- Moderate discomfort (3)
- Extreme discomfort (4)

Q36 Optional: Any additional information describing the perceived level of discomfort?

Q37 Do you feel that the euthanasia was performed too soon or too late in the patients life?

- Too soon (1)
- Optimal timing (2)
- Too late (3)

Q38 Optional: Why do you feel this way?

Display This Question:

If Was the client present for the euthanasia? Yes Is Selected

Or Was the client present for the euthanasia? Other Is Selected

Q39 Not including estimating client anguish over losing their pet, how do you think the euthanasia went from the client's perspective?

- Excellent (1)
- Good (2)
- Poor (3)
- Terrible (4)

Q40 Optional: Any additional information describing the estimated client perspective?

Q41 How much emotional distress did this particular euthanasia cause you?

- None at all (1)
- A little (2)
- A moderate amount (3)
- A lot (4)
- A great deal (5)

Q42 Optional: If you are able to do so, explain why you experienced this level of emotional distress?

Q43 We welcome any additional observations or comments regarding this euthanasia.

Appendix C: Deliverable for Sponsor

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Introduction

Euthanasia of pets is a large portion of veterinary practice, but an area that is not well studied. Due to the nature of the procedure, it can be agonizing for the patient, client, and even the veterinarian.

Every euthanasia is different, and while there are manuals that will list medications and techniques, these are purely technical. Is there a way to correctly “learn” how to perform a euthanasia so that everyone is satisfied every time? When performing euthanasia one must be a combination of anesthesiologist, undertaker, and clergy. In the context of a busy day, this process is often an energy and time consuming task.

Euthanasia is an ancient Greek term, roughly translating to “good death”.¹ What a good death is perceived as will change depending on how the veterinarian and client feel about the specific euthanasia instance. In most cases, if the pet has an easy transition from life to death, then the people involved in this process will feel better about putting the pet down.

¹ Cooney, K., Chappell, J., Callan, R., & Connally, B. (2012). *Veterinary euthanasia techniques: A practical guide*. John Wiley & Sons.

There are many facets to a successful euthanasia. This includes using medication, picking the proper euthanasia technique, and making the procedure as painless as possible for both the patient and the client. The most important note is that every animal is different, and so while veterinarians may use a protocol with most animals, they might have to use completely different techniques for some cases.

Euthanizing a pet is especially difficult because it is not only the pet that a veterinarian has to consider, but the owners as well. They are grieving and care must be taken so, if they wish, they may spend their last moments with their pet. It is always important to talk through the process with the client as possible vocalizations, twitching muscles, continued heartbeat for a short time, release of bowels and bladder, and agonal breaths can all occur that would upset the client.²

Literature has been written discussing the importance of helping the pet owner through the euthanasia process,^{3,4} as well as on the phenomenon of compassion fatigue that veterinarians and their staff may experience as they perform large numbers of euthanasia procedures.⁵ However, there has been little researched on the optimal euthanasia protocol specifically for pets, such as whether sedation should be used, and what medications are most efficient and least painful. One study by Hawkins et al⁶ discussed humane euthanasia of laboratory animals. These authors concluded that currently volatile anesthetics are the most humane method of rodent euthanasia, but that euthanasia methods must be reviewed and modified often to maintain their humanity. Unfortunately, this is different than pet euthanasia, as the species differ and there is no grieving owner to consider.

This study on cats and dogs is meant to help understand how veterinarians perform pet euthanasia, and what they estimate as the impact on the patient, the pet owner/client, and on themselves. The study aims to fill in the gaps of knowledge between the different euthanasia techniques, the consequences of these techniques on the animal, as well as the consequences for the client viewing and the veterinarian performing the euthanasia.

Methods

Researchers compiled a list of research questions pertaining to pet euthanasia to investigate through this study. Authors read two books: *Blue Juice* by Patricia Morris and *Veterinary Euthanasia Techniques* by Cooney et. Al. Using these resources, and other primary literature, research was collected that discussed the various techniques used to perform euthanasia. A draft survey was developed and sent to beta testers. The survey focused both on

² Morris, P. (2012). *Blue juice: euthanasia in veterinary medicine*. Temple University Press.

³ Martin, F., Ruby, K. L., Deking, T. M., & Taunton, A. E. (2004). Factors associated with client, staff, and student satisfaction regarding small animal euthanasia procedures at a veterinary teaching hospital. *Journal of the American Veterinary Medical Association*, 224(11), 1774-1779.

⁴ Fernandez-Mehler, P., Gloor, P., Sager, E., Lewis, F. I., & Glaus, T. M. (2013). Veterinarians' role for pet owners facing pet loss. *Veterinary Record*, 172(21), 555-555.

⁵ Scotney, R. L., McLaughlin, D., & Keates, H. L. (2015). A systematic review of the effects of euthanasia and occupational stress in personnel working with animals in animal shelters, veterinary clinics, and biomedical research facilities. *Journal of the American Veterinary Medical Association*, 247(10), 1121-1130.

⁶ Hawkins, P., Prescott, M. J., Carbone, L., Dennison, N., Johnson, C., Makowska, I. J., ... & Golledge, H. D. (2016). A Good Death? Report of the Second Newcastle Meeting on Laboratory Animal Euthanasia. *Animals*, 6(9), 50.

euthanasia protocol and emotional significance, and can be found in Appendix A. Suggestions from the initial review of the survey resulted in the survey being split into two surveys. The first including demographics and protocol, the second individual cases. These surveys can be seen in Appendix B. The surveys went through both the Tufts University Institutional Review Board and the WPI Institutional Review Board. The survey was then distributed in the form of a Qualtrics survey through multiple veterinary listservs, which are listed in Appendix C. The number of responses was capped at 557 and then quantitatively analyzed using Qualtrics and Microsoft Excel.

Results

There were 557 responses to the survey as of March 18th, 2017. 80% of these responses were female. The most common age of respondents was 31-40 years old (40%). In direct correlation with age, 44% of the participants graduated from veterinary school in 2000-2009. At the time of the survey, 36% of respondents estimated they had performed from 100-500 euthanasia procedures, and 48% had performed over 500 euthanasia procedures. Complete demographics can be found in Appendix 1A.

The majority of the respondents perform euthanasia in the hospital or clinic (67%), the rest perform only house calls (18%) or both (14%). If they perform the euthanasia in the clinic, there is a 73% chance that they have a specific euthanasia room (Appendix 2A).

The next questions asked center around the euthanasia training that responding veterinarians have undergone. This training could be during school or after veterinary school. Most respondents had no formal training (63%). If training did occur (37%), it most commonly involved 1-3 lectures (23%), not a core curriculum course (6%). (Appendix 3A).

When respondents were polled as to whether there are euthanasia textbooks available at the respondent's clinic to help in a difficult case, 83% answered no. When asked to comment, 26% said they weren't aware this resource existed, and 21% answered that they would like to own a book but do not (Appendix 3A).

Next, questions about the protocols used by clinics and the individual veterinarians were asked. 50% of clinics have a set protocol, and 40% this protocol is only related to interaction with the client. Client centered protocols can involve paperwork, use of comfort rooms, mementos of the pet (paw print, fur tuft, urn, etc), or anything else to give comfort. 70% of respondents answered that they do not wish to change their protocol, or if they did, it would be a client centered change (euthanasia room or better paperwork process). In addition, it is possible to have different protocols for a cat or a dog, but 68% of responding veterinarians use the same protocol regardless of animal type (Appendix 4A)

Dog and cat euthanasias are extremely similar in process. At the beginning of a euthanasia procedure, 95% of respondents have discussions with the client about the process that will occur. This can include the possibility of physical changes such as agonal breaths, eyes remaining open, body stretching or vocalization (Appendix 5A). The actual euthanasia process begins by selecting which vein to use for injections. For both dogs and cats, the cephalic vein is used 61%

of the time. The preferred method of injection was intravenous catheter (76% for dog, 74% for cat) and the client is usually not present for catheter insertion (55% for dog, 58% for cat) (Appendix 6A). Pre-euthanasia solution is used 53% of the time for dogs and 52% of the time for cats (Appendix 7A). and the standard medication used is propofol (40% for dogs, 37% for cats) (Figure 1a). The actual euthanasia solution used most frequently is euthasol (36% for both) (Figure 1b).

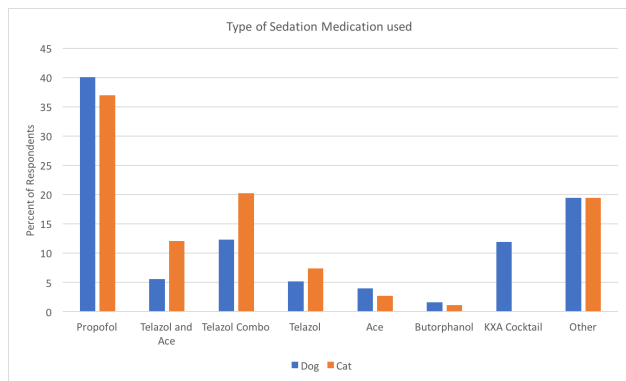


Figure 3a: Types of sedation medication used in both cats and dogs

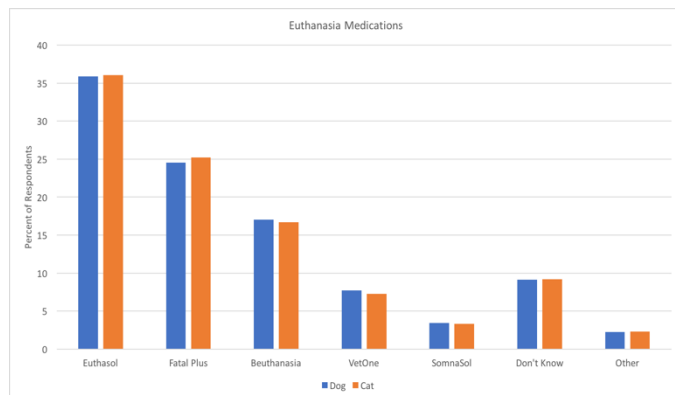


Figure 2b: Types of euthanasia medication used in both dogs and cats.

training and graduation year. In regards to formal euthanasia training, as the years have increased so has the formal training while in veterinary school. From 1970 to 1999 86% of students had no formal euthanasia training in veterinary school. Starting in 2000 that percentage dropped to 63.5%, and 2010 to 2016, the number lowered even further to 40% who have not had formal training in school (Figure 2a).

Additionally, as time has progressed euthanasia methods have changed. Of the veterinarians that graduated from 1970 to 1979, only 55% of them prefer to use an intravenous catheter to deliver euthanasia solution for both dogs and cats. In comparison, current graduates of 2010 to 2016, 77% prefer the use of intravenous catheter to deliver euthanasia solution for both dogs and cats (Figure 2b).

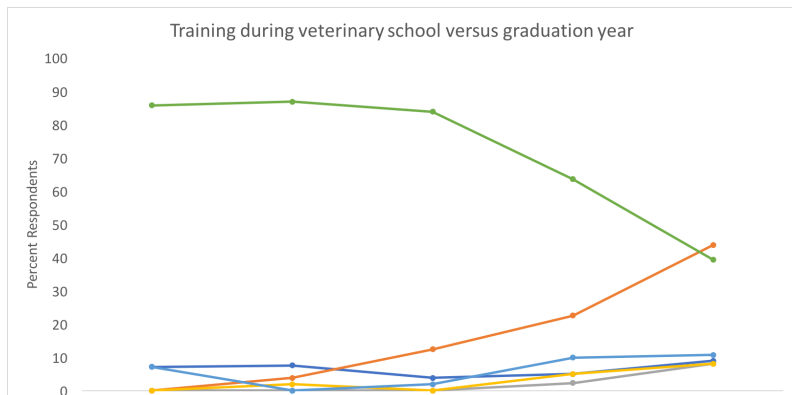


Figure 2a: Training during veterinary school versus graduation year over percent of respondents

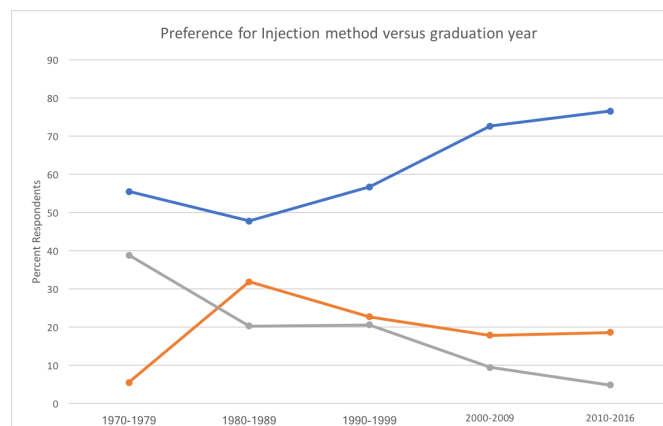


Figure 2b: Preference for injection method versus graduation year over percent of respondents.

Discussion

Veterinarians perform euthanasia extremely often. It is not unusual for someone 5 years out of veterinary school to have performed anywhere between 100 to 500 euthanasias (Appendix 1A). With such a high demand, it is necessary for veterinarians to complete the process well, in order to please the client, ease the patient's suffering, and to ensure their own emotional well-being.

The results of the euthanasia medication questions (Appendix B: Q33, Q45, Q57) bring up many interesting results when researched further. The first is that most medications have no difference in active ingredients. Between euthasol⁷, beuthanasia⁸, VetOne⁹, and SomnaSol¹⁰, all of these medications contain 390 mg/mL sodium pentobarbital and 50 mg/mL of phenytoin sodium. Additionally, they do not differ greatly in inactive ingredients. Fatal Plus is the only medication that differs, as it contains only 390mg/mL of sodium pentobarbital. It does not contain phenytoin sodium, which is an anti-seizure medication. Fatal Plus is also different because it is not approved by the FDA¹¹. Fatal Plus can still be marketed, but the FDA frowns upon this practice¹². This is most likely because sodium pentobarbital can create a high if injected in humans¹³, and the addition of phenytoin sodium negates this concern.

Almost 10% of veterinarians do not know the medication that they use to perform euthanasia (Figure 1b). Respondents stated that either a technician draws it up for them, or they have never bothered to read the label. Most only know what color the solution is, but with most of the solutions being pink and only fatal plus being blue, this was not specific enough for researchers to identify the medication.

In addition, Beuthasol was listed in the survey 23 times out of 490 respondents. This is interesting, as the medication does not actually exist¹⁴. Authors attempted to research information, and while Beuthasol has been used in IRB approved documents and other studies, no information on the active or inactive ingredients can be found. In one of the papers a laboratory was listed. A call was made to the manufacturers by the authors, and the manufacturers said that the medication has never been called “beuthasol”, but rather is the medication euthasol. Beuthasol was most likely a typo that was propagated.

Due to the initial design of the survey, the data was difficult to analyze. The protocol portion of the survey was split into three sections. The first section discussed protocols used for

⁷ http://www.virbacvet.com/pdf/product_pdfs/EUTHASOL_Euthanasia_Solution_sds.pdf

⁸ <https://www.drugs.com/vet/beuthanasia-d-special.html>

⁹ <http://www.vetone.net/Default/CatHeaderPage/1b6b43fd-d6c4-4b43-a142-d2c44755cc11>

¹⁰ <https://www.drugs.com/vet/somnasol.html>

¹¹ <https://www.fda.gov/downloads/AnimalVeterinary/Products/ApprovedAnimalDrugProducts/UCM042860.pdf>

¹²

<https://www.fda.gov/AnimalVeterinary/GuidanceComplianceEnforcement/ComplianceEnforcement/ucm229084.htm>

¹³ <https://dailymed.nlm.nih.gov/dailymed/archives/fdaDrugInfo.cfm?archiveid=80225>

¹⁴ Sherrill, J., Ware, L. H., Lynch, W. E., Montali, R. J., & Bush, M. (2001). Contrast Radiography With Positive-Pressure Insufflation in Northern Pintails (*Anas acuta*). *Journal of Avian Medicine and Surgery*, 15(3), 178-186.

both dogs and cats, while the second and third sections were specific to dog or cat respectively. This presented a problem, as it seemed respondents did not remember what animal they were answering questions about. For example, in the “dog section”, under sedations, it was frequent to see both animals listed with their respective medications. It is unknown whether or not any other areas of the survey were affected in a similar way, as most did not have open response boxes. Another complication with data analysis was the use of the “open-text” format, where a respondent could write what they wished in the box. This led to misspellings of various euthanasia medications, as well as difficulties analyzing pre-euthanasia medications, and caused researchers to devote much of their time to analyzing this data. In future, this format should be changed to a selectable method where various choices are given, with a response box for “other”.

As was shown above in results, euthanasia education has increased over time as it has become more important to veterinary practices. There has been a shift in America to pets being considered part of the family, and because of this a proper euthanasia is necessary for the pet owner to feel like it was the right decision¹⁵. More courses in the euthanasia process allow for the veterinarian to feel more prepared both technically and emotionally when they enter practices.

IV Catheter usage has also increased over time. This is most likely because IV catheters became mass producible in 1974.¹⁶ After this time, the technology would have taken some years to become integrated into the veterinary world. Using a catheter allows the veterinarian to know that when it is time to inject the sedation and euthanasia solution, they will not struggle with finding a vein or having an error in front of the client.

¹⁵ Wooten, S. J. (2016, February 23). Before the end: Prepare highly attached clients to face their pets' death. Retrieved April 12, 2017, from <http://veterinarymedicine.dvm360.com/end-prepare-highly-attached-clients-face-their-pets-death>

¹⁶ Rivera, A. M., Strauss, K. W., Van Zundert, A., & Mortier, E. (2005). The history of peripheral intravenous catheters: how little plastic tubes revolutionized medicine. *Acta Anaesthesiologica Belgica*, 56(3), 271.

Appendix A

Appendix 1A: Demographics

Age	Count	%
20-30	56	10.05%
31-40	226	40.57%
41-50	155	27.83%
51-60	88	15.80%
61-70	29	5.21%
Prefer not to say	3	0.54%
Total	557	100%
Gender	Count	%
Male	106	18.86%
Female	449	79.89%
Prefer not to say	7	1.25%
Total	562	100%

Year of graduation from veterinary school	Count	%
1970-1979	14	2.71%
1980-1989	54	10.44%
1990-1999	109	21.08%
2000-2009	226	43.71%
2010-2016	114	22.05%
Total	517	100.00%

At the time of the survey how many euthanasias do you believe you have performed?		
Answer	Count	%
0-100	79	14.47%
101-500	198	36.26%
501-1000	119	21.79%
Over 1000	150	27.47%
Total	546	100%

Appendix 2A: General Practice Information of Participants

Where do you perform euthanasia?		
Answer	Count	%
Hospital/Clinic	366	66.91%
House calls	97	17.73%
Both	79	14.44%
Other	5	0.91%
Total	547	100%

Is there a specific euthanasia room?		
Answer	Count	%
Yes	326	73.42%
No	118	26.58%
Total	444	100%

Do you refer your clients to a home euthanasia service?		
Answer	Count	%
Yes	209	39.43%
No	99	18.68%
Sometimes	22	41.89%
Total	530	100.00%

Does your hospital routinely offer home euthanasia appointments?		
Answer	Count	%
Yes	63	11.73%
No	303	56.42%
For special individual cases	105	19.55%
As a major part of my practice	66	12.29%
Total	537	100%

Do you wish to say why it does not?		
Answer	Count	%
ER	43	20.57%
Specialty	40	19.14%
Not Staffed	43	20.57%
Academic	18	8.61%
Referral Hospital	15	7.18%
Liability	10	4.78%
Unsure	9	4.31%
Other	13	6.22%
Will refer	18	8.61%
Total	209	100.00%

Appendix 3A: Training of Veterinarians

Have you had any formal training in euthanasia beyond cases seen during veterinary school?		
Answer	Count	%
Core curriculum course	33	6.03%
1-3 Lectures	125	22.85%
In a club	14	2.56%
Externship	26	4.75%
Other	48	8.78%
None	347	63.44%
Total	547	100%

Did you have any formal training in euthanasia after veterinary school?		
Answer	Count	%
Continuing education seminar	96	17.61%
I have read articles or books about euthanasia	145	26.61%
Mentored guidance during an internship	138	25.32%
Other	43	7.89%
None	239	43.85%
Total	545	100%

Are there euthanasia textbooks available at your clinic for reference?		
Answer	Count	%
Yes	90	16.89%
No	443	83.11%
Total	533	100%

Do you wish to comment?		
Answer	Count	%
Didn't Know it Existed	17	25.76%
Would like	14	21.21%
Online	8	12.12%
Human Consult	12	18.18%
Don't whether it exists in clinic	15	22.73%
Total	66	100.00%

Appendix 4A: Existence of Protocols

Does your clinic have established euthanasia protocols that all staff follows for every appointment?		
Answer	Count	%
Yes	278	51.48%
No	262	48.52%
Total	540	100%

Do you wish to comment on this?		
Answer	Count	%
Client Centered Protocol	47	39.50%
Technical protocol	42	35.29%
Basic overall	30	25.21%
Total	119	100.00%

Would you change the protocol if you could, if so to what?		
Answer	Count	%
Client Change	18	19.78%
Want a better option (less sting)	3	3.30%
Open	7	7.69%
No	63	69.23%
Total	91	100.00%

When performing a Euthanasia do you use the same protocol for a dog and a cat?		
Answer	Count	%
Yes	369	67.71%
No	176	32.29%
Total	545	100%

Appendix 5A: Discussion with client

	Is the euthanasia process discussed with the client beforehand?			
	Count		Percent	
	Dog	Cat	Dog	Cat
Yes	509	503	94.79	94.91
No	3	4	0.56	0.75
If time allows	25	23	4.66	4.34
Total	537	530	100	100

Appendix 6A: Injection Methods

	Which vein is typically used for the euthanasia solution?			
	Count		Percent	
	Dog	Cat	Dog	Cat
Cephalic Vein	325	323	60.63	61.06
Lateral Saphenous Vein	146	86	27.24	16.26
Medial Saphenous Vein	3	37	0.56	6.99
Other	62	83	11.57	15.69
Total	536	529	100.00	100.00

	Preferred method for injection			
	Count		Percent	
	Dog	Cat	Dog	Cat
Intravenous Catheter	408	391	75.98	74.48
Butterfly Needle	85	75	15.83	14.29
Direct Venipuncture (Syringe and Needle)	44	59	8.19	11.24
Total	537	525	100.00	100.00

	Is the client present when the catheter is inserted?			
	Count		Percent	
	Dog	Cat	Dog	Cat
Yes	25	16	6.13	4.10
No	224	225	54.90	57.69
Sometimes	159	149	38.97	38.21
Total	408	390	100.00	100.00

Appendix 7A: Is Pre-sedation used?

What sedation medications that are used can be found in Figure 1a.

	Is any type of pre-euthanasia sedation used?			
	Count		Percent	
	Dog	Cat	Dog	Cat
Yes	286	276	53.36	52.17
No	71	73	13.25	13.80
Sometimes	179	180	33.40	34.03
Total	536	529	100.00	100.00

Appendix B: Survey Questions

IRB approved-Demographics of the Veterinarian and their Euthanasia Protocol

Q1 Dear Colleague, Euthanasia is one of the significant challenges of a veterinary practitioner's work. We are fortunate to have several recent textbooks to guide us, but there is a critical need for research into factors that contribute positively or negatively to a satisfactory event. The purpose of this initial survey is to gather information on the techniques you utilize and the training and resources available to you for feline and canine patients. This information can then be used to support veterinarians in the U.S. Procedure: If you consent to participate, this survey takes approximately 10 to 15 minutes to complete. Following this, if you are willing to follow up with a study on specific experiences with your patients, you will be directed to a link for a short event survey that you can complete after you perform euthanasia on your patients. Risks and discomforts: You may experience an emotional reaction to reviewing and reporting your opinions about a euthanasia. Confidentiality: No information to identify you or your practice will be collected. At the end of this survey you will build a 3 character code, this will be used to pair your event surveys to your demographic information. You will also be invited to enter your email address to participate in a raffle for a euthanasia textbook (this is voluntary). Your email address is collected in a separate location and cannot be associated with your survey responses. Withdrawal of participation: Your participation is voluntary and you may decide at any time that you no longer wish to participate. You may decline to answer any question. Please contact the Principal Investigator if you have questions or concerns, or Lara Sloboda at the Office of the Institutional Review Board at (617) 627-3417. The author of this study is: Alicia Karas DVM DACVAA, Principal Investigator, anesthesiologist at Cummings School of Veterinary Medicine, Tufts University, North Grafton, MA 01536 alicia.karas@tufts.edu Kathleen Cooney DVM, Consultant, internationally recognized author and expert in hospice and euthanasia, founder of Home to Heaven, principal of Cooney Animal Hospice Consulting Julia Holtzman, Worcester Polytechnic Institute, Senior in pursuit of a undergraduate degree in Biology/Biotechnology Evelyn Platko, Worcester Polytechnic Institute, Senior in pursuit of a undergraduate degree in Biology/Biotechnology. Pursuing Veterinary School.

Q2 I have read and understood the purpose of this study and my rights as an informed participant. I wish to continue with the survey

- Yes (1)
- No (2)

If No Is Selected, Then Skip To End of Survey

Q3 Thank you for agreeing to be a part of our study! This is an initial one-time survey to gather information about your typical euthanasia techniques. After filling this out, you can choose to continue to participate in the second phase: a study designed to help us understand the impact that the euthanasia setting, drugs, patient status and other factors had on the quality of the euthanasia. You may bookmark a link to take this second survey every time you perform a

euthanasia, or when a special case comes up. This second survey focuses on the technical and the emotional aspects of each particular euthanasia. Thank you again!

Q4 Age

- 20-30 (1)
- 31-40 (2)
- 41-50 (3)
- 51-60 (4)
- 61-70 (5)
- Prefer not to say (6)

Q5 Gender

- Male (1)
- Female (2)
- Prefer not to say (3)

Q6 Are you a technician who is able to perform euthanasia in your state, or a doctor of veterinary medicine?

- Doctor of veterinary medicine (1)
- Technician (2)
- Other (3)

If Other Is Selected, Then Skip To End of Survey

Display This Question:

If Are you a technician or a doctor of veterinary medicine? Doctor of Veterinary medicine Is Selected

Q7 Year of graduation from veterinary school

- 1960 (1)
- 1961 (2)
- 1962 (3)
- 1963 (4)
- 1964 (5)
- 1965 (6)
- 1966 (7)
- 1967 (8)
- 1968 (9)
- 1969 (10)
- 1970 (11)
- 1971 (12)
- 1972 (13)
- 1973 (14)
- 1974 (15)
- 1975 (16)
- 1976 (17)
- 1977 (18)
- 1978 (19)
- 1979 (20)
- 1980 (21)
- 1981 (22)
- 1982 (23)
- 1983 (24)
- 1984 (25)
- 1985 (26)
- 1986 (27)
- 1987 (28)
- 1988 (29)
- 1989 (30)
- 1990 (31)
- 1991 (32)
- 1992 (33)
- 1993 (34)
- 1994 (35)
- 1995 (36)
- 1996 (37)
- 1997 (38)

- 1998 (39)
- 1999 (40)
- 2000 (41)
- 2001 (42)
- 2002 (43)
- 2003 (44)
- 2004 (45)
- 2005 (46)
- 2006 (47)
- 2007 (48)
- 2008 (49)
- 2009 (50)
- 2010 (51)
- 2011 (52)
- 2012 (53)
- 2013 (54)
- 2014 (55)
- 2015 (56)
- 2016 (57)
- 2017 (58)

Q8 Is your practice in the continental U.S.?

- Yes (1)
- No (2)

If No Is Selected, Then Skip To End of Survey

Q9 State of practice

- AL (1)
- AK (2)
- AZ (3)
- AR (4)
- CA (5)
- CO (6)
- CT (7)
- DE (8)
- FL (9)
- GA (10)
- HI (11)
- ID (12)
- IL (13)
- IN (14)
- IA (15)
- KS (16)
- KY (17)
- LA (18)
- ME (19)
- MD (20)
- MA (21)
- MI (22)
- MN (23)
- MS (24)
- MO (25)
- MT (26)
- NE (27)
- NV (28)
- NH (29)
- NJ (30)
- NM (31)
- NY (32)
- NC (33)
- ND (34)
- OH (35)
- OK (36)
- OR (37)
- PA (38)
- RI (39)
- SC (40)
- SD (41)

- TN (42)
- TX (43)
- UT (44)
- VT (45)
- VA (46)
- WA (47)
- WV (48)
- WI (49)
- WY (50)

Q10 Where do you perform euthanasia?

- Hospital/Clinic (1)
- House calls (2)
- Both (3)
- Other (4) _____

Q11 Does your hospital routinely offer home euthanasia appointments?

- Yes (1)
- No (2)
- For special individual cases (3)
- As a major part of my practice (4)

Display This Question:

If Does your hospital routinely offer home euthanasia appointments? No Is Selected

Q12 Do you wish to say why it does not?

Q13 Do you refer your clients to a home euthanasia service?

- Yes (1)
- No (2)
- Sometimes (3) _____

Display This Question:

If Do you work out of a clinic, or make house calls? Clinic Is Selected

Or Do you work out of a clinic, or make house calls? both Is Selected

Q14 Is there a specific euthanasia comfort room in your clinic?

- Yes (1)
- No (2)

Q15 Did you have any formal training during veterinary school in euthanasia beyond exposure to it via clinic cases?

- Core curriculum course (1)
- 1-3 Lectures (2)
- In a club (3)
- Externship (4)
- Other (5) _____
- None (6)

Q16 Did you have any formal training in euthanasia after veterinary school?

- Continuing education seminar (1)
- I have read articles or books about euthanasia (6)
- Mentored guidance during an internship (2)
- Other (4) _____
- None (5)

Q17 Does your clinic have established euthanasia protocols that all staff follows for every appointment?

- Yes (1)
- No (2)

Q18 Do you wish to comment on this?

Display This Question:

If Does your clinic have established euthanasia protocols all staff follows for every appointment?

Yes Is Selected

Q19 Would you change the protocol if you could, if so to what?

Q20 Does your practice have euthanasia technique books available for staff to refer to, especially if challenging situations present?

- Yes (1)
- No (2)

Q21 Do you wish to comment on this?

Q22 At the time of the survey how many euthanasias do you believe you have performed?

- 0-100 (1)
- 101-500 (2)
- 501-1000 (3)
- Over 1000 (4)

Q23 When performing a Euthanasia (including both pre-euthanasia and euthanasia) do you use the same protocol for a dog and a cat?

- Yes (1)
- No (2)

Q24 The following questions pertain to your typical protocol for both dog and cat euthanasia (including both pre-euthanasia and euthanasia) .

Q25 Is the euthanasia process discussed with the client beforehand, including possible physical changes such as: agonal breaths, eyes remaining open, body stretching, or vocalization?

- Yes (1)
- No (2)
- If time allows (3)

Q26 Do you wish to comment on this?

Q27 Is any type of pre-euthanasia sedation by oral, subcutaneous, or intramuscular routes used?

- Yes (1)
- No (2)
- Sometimes (3)

Display This Question:

If Are pre-euthanasia sedation by oral, subcutaneous, or intramuscular route used? Yes Is Selected

Q28 Which medication or combination of medication are used for sedation?

Q29 Which is you preferred method for injection of euthanasia solution?

- Intravenous Catheter (1)
- Butterfly Needle (2)
- Direct Venipuncture (Syringe and Needle) (3)

Display This Question:

If Which is you preferred method for injection of euthanasia solution? Intravenous Catheter Is Selected

Q30 Is the client present when the catheter is inserted?

- Yes (1)
- No (2)
- Sometimes (3)

Q31 Which vein is typically used for the euthanasia solution injection?

- Cephalic Vein (1)
- Lateral Saphenous Vein (2)
- Medial Saphenous Vein (3)
- Other (4) _____

Q32 Which other routes of injection have you used for administering euthanasia solution?

- Intraperitoneal (2)
- Intrahepatic (3)
- Intrarenal (4)
- Intracardiac (5)
- Other (6) _____

Q33 What is the specific type of euthanasia solution used (medication name and if possible brand)?

Q34 Optional: Why do you use this particular solution?

Q35 Is there anything else you'd like to tell us about your euthanasia protocol or procedures?

Q36 The following questions pertain to your typical protocol for dog euthanasia (including both pre-euthanasia and euthanasia) .

Q37 Is the euthanasia process discussed with the client beforehand, including possible physical changes such as: agonal breaths, eyes remaining open, body stretching, or vocalization?

- Yes (1)
- No (2)
- If time allows (3)

Q38 Do you wish to comment on this?

Q39 Is any type of pre-euthanasia sedation by oral, subcutaneous, or intramuscular routes used?

- Yes (1)
- No (2)
- Sometimes (3)

Display This Question:

If Are pre-euthanasia sedation by oral, subcutaneous, or intramuscular route used? Yes Is Selected

Q40 Which medication or combination of medication are used for sedation?

Q41 Which is your preferred method for injection of euthanasia solution?

- Intravenous Catheter (1)
- Butterfly Needle (2)
- Direct Venipuncture (Syringe and Needle) (3)

Display This Question:

If Which is you preferred method for injection of euthanasia solution? Intravenous Catheter Is Selected

Q42 Is the client present when the catheter is inserted?

- Yes (1)
- No (2)
- Sometimes (3)

Q43 Which vein is typically used for the euthanasia solution injection?

- Cephalic Vein (1)
- Lateral Saphenous Vein (2)
- Medial Saphenous Vein (3)
- Other (4) _____

Q44 Which other routes of injection have you used for administering euthanasia solution?

- Intraperitoneal (2)
- Intrahepatic (3)
- Intrarenal (4)
- Intracardiac (5)
- Other (6) _____

Q45 What is the specific type of euthanasia solution used (medication name and if possible brand)?

Q46 Optional: Why do you use this particular solution?

Q47 Is there anything else you'd like to tell us about your euthanasia protocol or procedures?

Q48 The following questions pertain to your typical protocol for cat euthanasia (including both pre-euthanasia and euthanasia) .

Q49 Is the euthanasia process discussed with the client beforehand, including possible physical changes such as: agonal breaths, eyes remaining open, body stretching, or vocalization?

- Yes (1)
- No (2)
- If time allows (3)

Q50 Do you wish to comment on this?

Q51 Is any type of pre-euthanasia sedation by oral, subcutaneous, or intramuscular routes used?

- Yes (1)
- No (2)
- Sometimes (3)

Display This Question:

If Are pre-euthanasia sedation by oral, subcutaneous, or intramuscular route used? Yes Is Selected

Q52 Which medication or combination of medication are used for sedation?

Q53 Which is your preferred method for injection of euthanasia solution?

- Intravenous Catheter (1)
- Butterfly Needle (2)
- Direct Venipuncture (Syringe and Needle) (3)

Display This Question:

If Which is your preferred method for injection of euthanasia solution? Intravenous Catheter Is Selected

Q54 Is the client present when the catheter is inserted?

- Yes (1)
- No (2)
- Sometimes (3)

Q55 Which vein is typically used for the euthanasia solution injection?

- Cephalic Vein (1)
- Lateral Saphenous Vein (2)
- Medial Saphenous Vein (3)
- Other (4) _____

Q56 Which other routes of injection have you used for administering euthanasia solution?

- Intraabdominal (2)
- Intrahepatic (3)
- Intrarenal (4)
- Intracardiac (5)
- Other (6) _____

Q57 What is the specific type of euthanasia solution used (medication name and if possible brand)?

Q58 Optional: Why do you use this particular solution?

Q59 Is there anything else you'd like to tell us about your euthanasia protocol or procedures?

Q60 We are grateful for your participation! The second phase of our study is to examine how various factors affect the individual experience of euthanasia – how it was for the patient, the caregiver, and for you and your staff. There is a second survey that can be taken after each and every euthanasia you perform over the next 12 months. It is meant to capture unique information from individual cases to contribute to an understanding of factors that affect the

experience. The link to this survey can be bookmarked on your computer or smartphone for easy access. The link can be found before you leave the survey.

Q61 If you plan to take the second survey, please make a confidential identifier. The purpose of this identifier is to link your surveys back to your demographics and protocol. It will be: First initial of first name.number of older siblings at your birth.first letter of the town in which you were born. Please enter this below for our record keeping.

Q62 Here is the link to the second survey:

https://tufts.qualtrics.com/SE/?SID=SV_doR9m7wfdZ4liXX To be able to access it once this survey is done please either right click and open in a new tab if you're on a computer. If you're on a smart phone hold down the link until the option appears to open in a new tab. Thank you!

Appendix C: List Servs

ACVAA

Doctors at Tufts

TuftsVETS

IVAPM

Lap of Love

Pet Loss at home

IAAHPC

VCA

VIN

Emergency and Critical Care lists-VECCS

In home pet euthanasia directory