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Barriers to Client Compliance and Understanding of Heartworm Prevention in the Canine Patient

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Murray State University Honors College

HONORS THESIS

Certificate of Approval

Barriers to Client Compliance and Understanding of Heartworm Prevention in the Canine
Patient

Emily Fischels
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Approved to fulfill the
requirements of HON 437 or 438

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Approved to fulfill the
Honors Thesis requirement
of the Murray State Honors
Diploma

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Barriers to Client Compliance and Understanding of Heartworm Prevention in the Canine
Patient

Submitted in partial fulfillment
of the requirements
for the Murray State University Honors Diploma

Emily Fischels

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Abstract

Dirofilaria immitis is a common and largely preventable mosquito-borne parasite that causes dirofilariasis, or heartworm disease, in a number of animal species. The necessity of heartworm prevention in the canine patient is undisputed and well-known among veterinary professionals, yet there are still many dogs not protected from this fatal parasite. Heartworm prevention traditionally requires a once-a-month administration of medication; therefore, its efficacy relies on owner compliance. The barriers to canines receiving heartworm prevention were assessed using a survey targeted at pet owners whose dogs have seen the veterinarian in the past year. The main barriers identified were inadequate client communication and understanding, expense of prevention, and forgetfulness. The goal of this research is to establish the barriers to pets receiving monthly heartworm prevention so that veterinary professionals can be made aware and work to address them in order to reduce the number of dogs infected.

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Introduction

The topic of heartworms and heartworm prevention is part of daily conversation for a general practice veterinarian and their staff. A veterinary professional may talk with clients about this disease upwards of ten times a day, but according to a 2019 study only 25% of dogs are actually on consistent heartworm prevention (Johnson and Padgett.) Clients want to keep their pets happy and healthy, and veterinarians want to help pet owners do just that. There are so many diseases that even the best veterinarian cannot prevent or even treat, but heartworm disease is not one of them. Recommending and giving heartworm prevention is a simple way to prevent heartworms and keep pets healthy. So why are only 25% being protected from this disease?

There is a disconnect between the scientific evidence that heartworm prevention is necessary and what really happens when the pet leaves the vet clinic. In veterinary medicine there is an intermediate between doctor recommendations and the care that the patient receives: the client, or pet owner. It is the job of the veterinary professional to give clients the tools they need and empower them to be an active part in their pet's health. This research will seek to identify the barriers to pets receiving heartworm prevention so that veterinary professionals can address the barriers to better serve clients and prevent as many pets as possible from contracting this fatal parasite. The barriers investigated will mainly focus on the communication between the veterinary professional and the client, but also include factors such as expense of prevention and forgetfulness.

Background:

Life Cycle

Heartworm disease is a serious, life-threatening disease caused by infection with *Dirofilaria immitis*, a parasitic worm. The canine patient is a definitive host for this parasite and the pulmonary artery is its preferred final destination. The life cycle for this parasite begins when any of up to seventy mosquito species draws a blood meal from an animal infected with heartworms (Aiello and Moses 127.) The mosquito ingests larval stage 1 (L1) of the parasite, known as microfilaria. The parasite matures from L1 to L3 in the mosquito over a period of 10-30 days and migrates from the gut to the mouth parts (Barnette and Ward.) L3 is considered the infective stage of *Dirofilaria immitis*, at this stage the mosquito can infect a canine through a bite. Once a patient is infected, within 3-9 days the parasite matures to stage L4 in the subcutaneous tissue and migrates through the tissues and muscle fibers. The parasite molts one last time between day 50 and day 70 as they migrate through the body into the circulatory system. These immature adults can reach the pulmonary vasculature as early as day 67 (American Heartworm Society [AHS] 9-10.) The worms mature in the pulmonary arteries and can reach up to 12 inches in length (AHS 10.) Once the female worm is sexually mature, she will begin to release microfilaria, or larval stage 1. Microfilaria can be detected in the blood of an infected patient as early as six months after infection. From this point on this patient is a danger to other dogs as mosquitos can become infected from feeding on the patient and begin the cycle once again, infecting animals up to one hundred miles away. The American Mosquito Control Association states that most species of mosquitos have flight ranges of one to three miles, but some have been known to migrate up to one hundred miles. Microfilaria may survive

for up to two years in the patient waiting for the mosquito to arrive and become the intermediate host but left untreated the adult worms will continue to produce new microfilaria (Aiello and Moses 128.)

Clinical Signs

The presence of heartworms in the canine heart is disruptive to the natural physiology of the body, and this manifests through many different clinical signs. The worms initially live in the pulmonary arteries, but as their size and numbers grow, they can invade the right ventricle, right atrium, and even the vena cava (AHS 10.) Adult worms typically live for three to five years in the patient and during that time they are altering the normal function of the heart (Aiello and Moses 128.) Merck Veterinary Manual states “Live adult heartworms cause direct mechanical trauma, and other suspected factors (eg, antigens and excretions) are thought to directly irritate or stimulate the hosts’ immune system to damage vessel intima.... the presence of dead worms leads to more severe vascular reactions and subsequent lung pathology...” (Aiello and Moses 128.) The residence of the worms in the heart and the damage they inflict there can cause clinical signs in other areas of the patient. Barnette and Ward list the most obvious clinical signs of heartworm disease as a soft, dry cough, shortness of breath, weakness, listlessness, and loss of stamina. Unfortunately, by the time these clinical signs are noticed the parasites have already done permanent damage to the heart muscle.

Parasite presence in the heart causes the heart to work harder to contract, resulting in hypertrophy of the muscle and eventual decrease in the blood flow out of the heart and increased pressure. If the disease is far enough progressed this heart enlargement is significant

enough to be seen on radiographs. This heart enlargement puts pressure on and can even displace the trachea dorsally, this pressure is the cause of the signature cough associated with heartworm disease. The patient experiences weakness and loss of stamina due to the increased workload on the heart to perform its function. If the heart is already struggling to meet demands when the patient is at rest, it's inadequacy will become apparent with exercise. The patient will have an increased respiratory rate and a decreased activity level. Shortness of breath occurs when the ability of the heart to pump blood to the lungs is compromised. The presence of the worms impedes the natural blood flow of deoxygenated blood from the right side of the heart to the lungs. This back-up of blood can also cause ascites, or a buildup of fluid in the abdomen. At this point, the heart has begun to fail.

Unfortunately, when the disease has progressed to heart failure there is little to be done to improve the quality of life for the patient or the time they have left. When a client brings their pet to the veterinarian with symptoms such as cough, exercise intolerance, and ascites the damage to the heart is extensive and permanent which means only the symptoms can be managed. It takes years for heartworm disease to progress to this stage; when caught early through annual heartworm testing, there is a conversation to be had about treating the heartworms to prevent heart failure and the symptoms associated with it.

Testing

The American Heartworm Society recommends annual heartworm testing for all canines regardless of clients' compliance with heartworm prevention. There are several reasons why a patient on heartworm prevention may still contract heartworms including forgotten or late

doses, or a patient vomiting or rubbing off prevention. Even with perfect heartworm prevention compliance there is still a small chance of infection with prevention-resistant parasites. An annual heartworm test ensures that the disease can be caught in its earliest stages to discuss treatment options before permanent damage is done. Additionally, a patient should be tested before beginning heartworm prevention if their history on prevention is unknown or inconsistent. Starting a patient with a high parasite load on heartworm prevention can cause dangerous side effects, therefore the risks should be assessed and discussed with the client before beginning prevention.

There are two broad types of heartworm tests: antigen testing with an enzyme-linked immunosorbent assay (ELISA) test and microfilaria testing, most commonly performed by examining a blood sample under the microscope. The American Heartworm Society recommends both an antigen and microfilaria test be performed annually due to the possibility of both tests giving false negatives in unique circumstances (16.) The ELISA test is the most sensitive and tests for the presence of the adult heartworms themselves through detection of an antigen produced by the adult female parasite, but antigen-antibody complexes can cause false negative results (AHS 16.) The ELISA test is the most used for annual testing of asymptomatic patients and when seeking a result for a suspected positive patient (Aiello and Moses 130.) The microfilaria testing can give a false negative result because about twenty percent of positive patients are not microfilaremic, and that figure is higher for patients on prevention (AHS 17.)

Treatment

Heartworm “treatment” can mean a variety of different things and employ different drugs and protocol, but generally refers to the administration of an adulticide, a medication that kills adult heartworms. The recommended treatment plan can vary based on the patient’s symptoms (or lack thereof) and other factors such as age and activity level. The only adulticide approved for heartworm treatment is melarsomine dihydrochloride. Merck Veterinary Manual states that melarsomine is given at a 2.5mg/kg dose intramuscularly in the epaxial musculature in the area of the third to fifth lumbar vertebrae (133.) This drug is an arsenic containing compound and carries the risk for side effects from local reaction at the injection site to sudden death caused by a pulmonary thromboembolism. A pulmonary thromboembolism occurs when a piece of dead heartworm dislodges into circulation and causes a blockage in the lungs. The risk of this deadly occurrence can be reduced by strictly reducing activity and excitement of the patient through methods such as cage rest and leash walking to use the bathroom.

Melarsomine is often given in conjunction with other medications the most common of which being doxycycline and prednisone. Doxycycline is given to kill *Wolbachia pipiens*, a bacterium necessary for normal maturation, reproduction, and infectivity of the heartworm. If *Wolbachia* are killed the adult heartworm gradually dies (Aiello and Moses 128.) Prednisone helps control the clinical signs of pulmonary thromboembolism during treatment. The following table shows the American Heartworm Association recommended protocol for the treatment of adult heartworms.

Day	Treatment
Day 0	<p>In a dog diagnosed and verified as heartworm positive:</p> <ul style="list-style-type: none"> • Positive antigen (Ag) test verified with microfilaria (MF) test • If no MF are detected, confirm with second Ag test from a different manufacturer • Apply an EPA-registered canine topical product labeled to repel and kill mosquitoes • Begin exercise restriction—the more pronounced the signs, the stricter the exercise restriction <p>If the dog is symptomatic:</p> <ul style="list-style-type: none"> • Stabilize with appropriate therapy and nursing care • Prednisone prescribed at 0.5 mg/kg BID first week, 0.5 mg/kg SID second week, 0.5 mg/kg every other day (EOD) for the third and fourth weeks
Day 1	<ul style="list-style-type: none"> • Administer appropriate heartworm preventive <ul style="list-style-type: none"> ◦ If MF are detected, pre-treat with antihistamine and glucocorticosteroids, if not already on prednisone, to reduce risk of anaphylaxis ◦ Observe for at least 8 hours for signs of reaction
Days 1–28	<ul style="list-style-type: none"> • Administer doxycycline 10 mg/kg BID for 4 weeks <ul style="list-style-type: none"> ◦ Reduces pathology associated with dead heartworms ◦ Disrupts heartworm transmission
Day 30	<ul style="list-style-type: none"> • Administer appropriate heartworm preventive • Apply an EPA-registered canine topical product to repel and kill mosquitoes
Days 31-60	<p>A one-month wait period following doxycycline before administering melarsomine is currently recommended as it is hypothesized to allow time for the <i>Wolbachia</i> surface proteins and other metabolites to dissipate before killing the adult worms. It also allows more time for the worms to wither as they become unthrifty after the <i>Wolbachia</i> endosymbionts are eliminated.</p>
Day 61	<ul style="list-style-type: none"> • Administer appropriate heartworm preventive • Administer first melarsomine injection, 2.5 mg/kg intramuscularly (IM) • Prescribe prednisone 0.5 mg/kg BID first week, 0.5 mg/kg SID second week, 0.5 mg/kg EOD for the third and fourth weeks • Decrease activity level even further: cage restriction; on leash when using yard
Day 90	<ul style="list-style-type: none"> • Administer appropriate heartworm preventive • Administer second melarsomine injection, 2.5 mg/kg IM • Prescribe prednisone, 0.5 mg/kg BID first week, 0.5 mg/kg SID second week, 0.5 mg/kg EOD for the third and fourth weeks
Day 91	<ul style="list-style-type: none"> • Administer third melarsomine injection, 2.5 mg/kg IM • Continue exercise restriction for 6 to 8 weeks following last melarsomine injections
Day 120	<ul style="list-style-type: none"> • Test for presence of MF <ul style="list-style-type: none"> ◦ If positive treat with a microfilaricide and retest in 4 weeks • Continue a year-round heartworm prevention program based on risk assessment described in prevention section
Day 365	<ul style="list-style-type: none"> • Antigen test 9 months after last melarsomine injection; screen for MF • If still Ag positive, re-treat with doxycycline followed by two doses of melarsomine 24 hours apart

Figure 1 (AHS 25) American Heartworm Association recommended protocol for the management of adult heartworms.

Some patients are simply not a candidate for treatment due to the toll it takes on the body such as geriatric patients and those with advanced disease. The risk for severe and deadly side effects of the melarsamine injections significantly increases in patients who are exhibiting symptoms such as a cough. Additionally, treatment may not be an option due to the financial constraints of the client. The AHS states that the average cost of treatment for a forty-pound dog is between \$1,200 and \$1,800 including all medications and diagnostics. The patient's

veterinarian may recommend a variation of the mentioned medications and protocol to fit the patient's individual circumstances. One of the alternative methods is the long-term use of heartworm prevention to kill the adult heartworms slowly over time.

The slow kill method of treatment is not recommended by the AHS but is an intermediate between the "gold standard" of care and no treatment at all. The clients budget often plays a large role in the use of this method. In this approach monthly ivermectin with or without doxycycline and prednisone is given and will shorten the lifespan of the adult heartworm. Most notably, the adulticide melarsamine is not used in this method. According to the AHS it has been shown to take over two years for the adult heartworms to die using this method (30.) During that time the disease is progressing as the worms are still causing damage to the heart muscle. Additionally, these patients continue to serve as a vector for the parasite because the adult heartworms are still reproducing and releasing microfilaria into circulation to be ingested by a mosquito. It is also mentioned that this method contributes to resistant subpopulations of heartworms (AHS 30.)

Prevention

There are many different drugs and brand names classified as heartworm prevention, but all of them are in the same class of macrocyclic lactones and serve the same purpose: kill heartworms and their life stages. Heartworm prevention kills all stages of the parasite except L2, which resides only in the mosquito. However, as mentioned, the prevention alone can take years of consistent use to kill L6, or adult heartworms. The intended use of heartworm prevention is to kill L3 as soon as it enters the patient via a mosquito bite before it has time to

mature and cause harm to the patient. Heartworm preventative will protect against L3 and L4 stages for the time period that it is labeled for, beyond that time period protection is unpredictable.

Prevention-resistant parasites have been recognized; however, “lack of efficacy” events are better explained by other causes such as failure to administer the prevention at the proper dose and frequency and failure of sufficient absorption of the active ingredient due to emesis (AHS 10.) A study conducted to review patients that tested positive for heartworm antigen while on heartworm prevention found that 80.7% of these patients had a gap in administration of prevention. Only 1.7% of cases had no purchase gaps and no factors that could influence or indicate insufficient administration of heartworm preventive (Atkins et al 109.) While resistance has been identified, it is not common. Macrocyclic lactones are highly effective and one of the safest medications used in veterinary medicine when administered according to label instructions (AHS 9.)

Clients have several routes of administration to choose from for their dogs’ heartworm prevention: topical, oral, and parenteral. Oral preventatives are designed for the patient to eat freely when given; they are often in the form of a chew and contain a flavor additive to aid in palatability of the medication. The somewhat recent addition of an injectable option administered by a veterinarian allows clients who may not be able to administer medication to their pet a safe, effective option for heartworm prevention. Additionally, the injectable form comes in a six-month and twelve-month formulation relieving the client of a monthly responsibility. However, this convenience comes at a cost that not all pet owners can afford; many clients still elect a monthly preventative.

For the most part, veterinarians see healthy patients once a year. The client brings their pet in for an exam and vaccinations, and they are mentally “checked off” for an entire year. In one visit that may last fifteen minutes veterinary staff must impress the importance of heartworm prevention on the client well enough for them to make it a point to give their pet prevention every thirty days. To prevent this disease, clients must take their pet's health into their own hands when the veterinary staff is no longer there. Clients must see the value in giving the prevention both to carry out the proper administration and to justify the cost of the prevention.

Not only must we impress upon the client the necessity of monthly heartworm prevention, but also the need for annual heartworm testing at an additional expense. The nature of the disease is such that no symptoms will be noticed until extensive permanent damage has been done. It is difficult for all parties involved to find out that a pet has a fatal disease that was completely preventable and could have been treated if caught early. When the disease is caught early through annual testing treatment is still extensive, expensive, and difficult on the pet. The best situation is for canine patients to receive consistent, veterinarian recommended heartworm prevention twelve months out of the year.

There are many factors involved as to why pets do not receive heartworm prevention and annual testing. These factors will be explored using the results of a survey targeted at dog owners whose pets have seen a veterinarian in the past year. Once identified, veterinary professionals can seek to find more ways to support pet owners in protecting their dogs from this disease.

Methods and Procedures

The scientific evidence of heartworm life cycle, disease, and prevention has been laid out to show the indisputable fact that consistent, veterinarian recommended heartworm prevention is medically necessary for canine patients. This research seeks to find the barriers to pets receiving this medication through a survey targeted at pet owners, the individuals responsible for purchasing and administering heartworm prevention. The target of the survey was clients whose pets have been seen by a veterinarian in the past year due to the fact that heartworm prevention is a prescription medication that requires an exam by a veterinarian. The hypothesis is that the clients whose pets who do not receive heartworm prevention are simply unaware of its necessity or confused about which products to use and their administration, thus leading one to believe the issue lies in the communication between veterinary professionals and clients.

The survey was approved by the Murray State Institutional Review Board and was estimated to take no longer than ten minutes to complete. Participants were made aware of their rights to decline to answer questions or leave the survey entirely once beginning as well as a reasonable assurance of confidentiality. The survey consisted of multiple choice, open response, and select all that apply questions as well as an opportunity to add any additional thoughts. At the close of the survey a statement advising participants to contact their veterinarian with any questions regarding their pets' health was included. The Google Forms survey and participation consent can be found in the appendices.

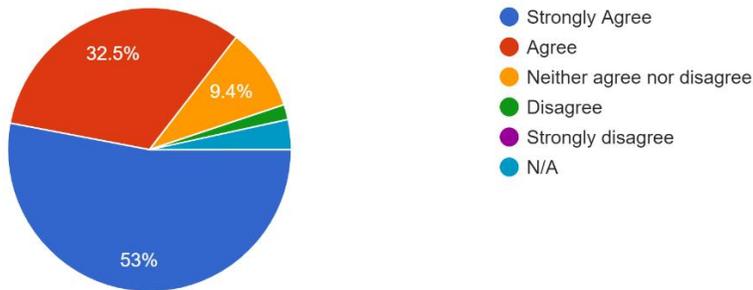
The survey was disseminated in an online format through Facebook with the title “Barriers to Client Compliance and Understanding of Heartworm Prevention in the Canine Patient.” A flier with a link to the survey was also advertised in various pet-related businesses and parks. The survey was available to the public for three weeks. Due to the nature of the primary investigators circle of peers a larger than average number of respondents were formally educated or employed in the field of veterinary medicine. This is acknowledged as causing somewhat of a bias in results; however, these responses can be separated and analyzed independently due to a specific yes or no question about formal education or employment in the field of veterinary medicine. It is also acknowledged that results will be skewed due to the title of the survey indicating its subject matter of heartworm prevention. Potential participants uneducated in this matter may have chosen not to respond due to their lack of knowledge and/or interest. The percentage of pets receiving heartworm prevention may be inflated, but the information regarding barriers should provide a reasonably full picture.

Results

The survey received one hundred and seventeen responses in the twenty-five days it was available. The participants represented the care of two hundred and twenty-eight canines. All participants were the primary caretaker of at least one dog, and 99.1% of those participants owned dogs over the age of six months. Due to the overwhelming majority of canines represented being over 6 months, the results will not be skewed by patients who are too young to receive prevention. It is noted that the one participant with a young dog indicated that they had already started giving prevention and planned to continue as prescribed.

Over 99% of participants indicated that a veterinary professional had spoken with them about heartworm prevention. The most common professional to speak with clients about heartworm prevention was the veterinarian at 95.6% followed by the technician and receptionist at 41.6% and 14.2% respectively. Figure 1 shows how well the client understood what was being discussed.

I left the conversation with a full understanding of why heartworm prevention was recommended.
117 responses



I left the conversation with a full understanding of when and how to give heartworm prevention.
117 responses

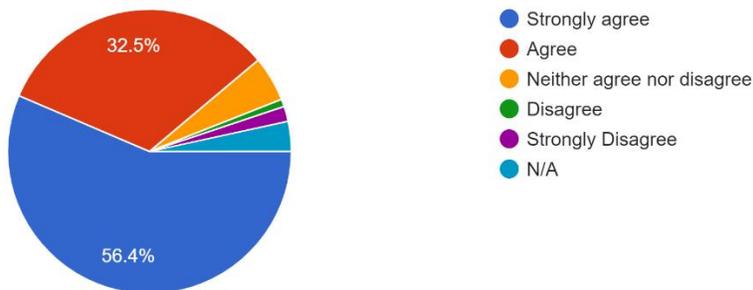


Figure 2. Pie charts reflecting the responses of participants when asked to identify how well they understood why heartworm prevention was recommended as well as understanding of when and how to give prevention.

The percentage of participants that indicated anything other than the correct answer of once monthly or every thirty-day administration when asked how often oral/topical prevention should be given was 15.7. This question received only 102 answers out of the 117 participants. A majority (67.5%) of participants indicated the importance of heartworm prevention as a ten out of ten. The full spread of responses can be seen in Figure 3.

How important do you feel giving heartworm prevention is?
117 responses

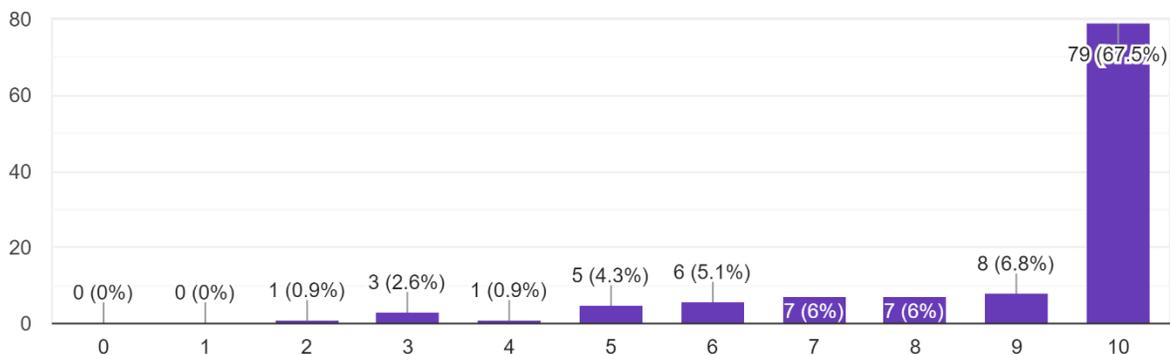


Figure 3. Bar graph showing the number of responses from zero to ten when participants were asked to rank how important giving heartworm prevention is.

All participants answered the question “Is your dog(s) on heartworm prevention,” 83.8% indicated “yes” and zero participants responded “unknown.” If one were to exclude all responses from participants formally educated or employed in the field of veterinary medicine the percentage of “yes” responses would be slightly lower at 82.1%. Seventy-four percent of participants indicated that they strive to give prevention year-round and 10.4% strive to give it only during the warm months of the year. One participant indicated that they strive to give prevention once every three months, and the remaining responses indicated that they do not give any prevention. Figure 4 indicates how many months out of the year participants actually

manage to give prevention. The majority of participants indicated that they give prevention twelve months out of the year.

My pet actually receives heartworm prevention ___ months out of the year
99 responses

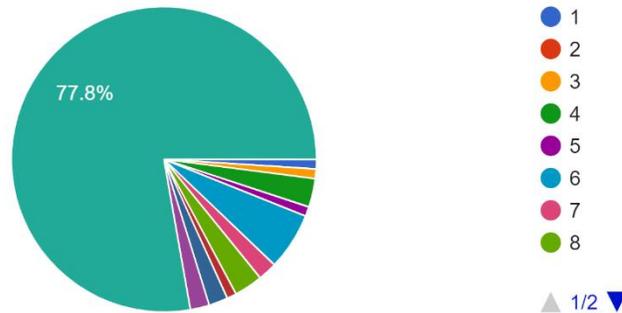


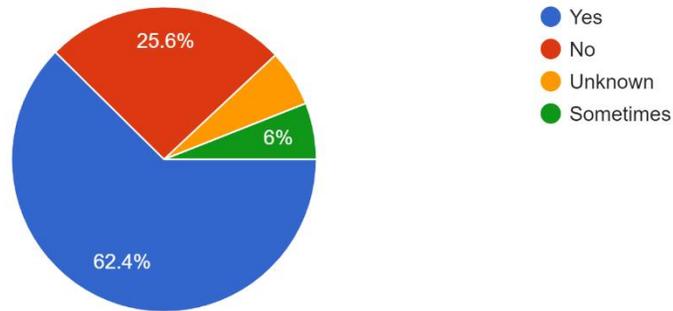
Figure 4. Pie chart reflecting how many months out of the year participants administer heartworm prevention. Colors light purple, dark blue, and red represent eleven, ten, and nine months respectively.

Participants who do not give any heartworm prevention were asked to identify a reason, twenty-three responses were collected. Finances was a factor for 34.7% of respondents, 30.4% used their pet’s low likelihood of infection as rational, and 13% indicated that they do not believe prevention is effective at preventing heartworms. Each of the following sentiments was indicated by at least one participant: heartworm prevention is deadly, forgetfulness, and not having time for a veterinary appointment. A total of thirty-nine responses were collected from the question asking participants who give some prevention but not 12 months out of the year to indicate why. This was a select all that apply question. One third of participants said they did not believe prevention was necessary in the winter/cooler months and an additional one third said they forget to give prevention. Twenty point five percent of participants indicated that

they forget to buy prevention, 5.2% indicated expense, and 2.6% said it was because their pet rarely goes outside.

Does your dog receive an annual heartworm test?

117 responses



If not, why is that?

33 responses

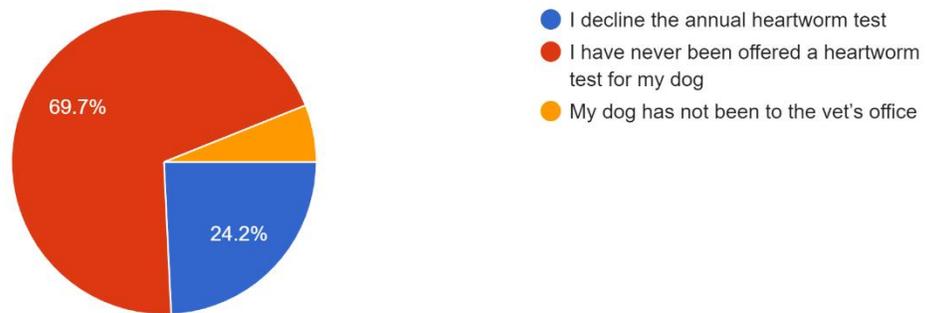


Figure 5. Pie charts reflecting participant responses regarding annual heartworm testing and rational for lack of testing.

When asked to explain why they declined the annual heartworm test the overwhelming majority listed that they did not believe it was necessary if their pet was on year-round prevention. There were two responses that mentioned cost and risk factor.

When participants were asked if they would like more information on heartworms and how to protect their dog 86.5% indicated “no.” Below in figure 5 are the parting thoughts of participants that the investigator deems relevant to the research. For the sake of transparency all spelling and grammatical errors are included.

Would you like to add anything?

I don't think that it's stressed nearly enough to clients that most prevention needs to be given regularly and on the same day every month. I am a vet tech major which is how I know that, but I didn't know it before I entered this program. I also don't think there's enough emphasis on needing to do it year round, or at least there wasn't by my vet that I take my dogs to.

My dog had heart worm while taking a heart worm preventative.

Do the research before giving any heartworm or flea and tick prevention. It may save your dogs life. These are insecticides you are feeding your babies.

For years I gave the monthly meds, no heartworm. Then I quit since dogs are inside dogs, and for years now, no heart worm. That makes me question whether the meds are necessary for indoor mostly dogs.

I found even if I gave heartworm pills to my dog every month he still has to be tested to see if he has it. That makes no sense. He was taking all year long n being tested. Just to get money for test. Prices of both pills n test should not be so expensive n people would get more often. It's just too expensive!!!

When I have issued in the past it has been for just not remembering or running out of meds. I wish the vet would like send me reminders texts about the meds. It's not thier responsibility, but it would be nice if there was like a automated system to prompt me.

We love our dog very much, however, going to the vet is expensive so we choose to take care of him best we can and pay our doctor visits instead. Sad but true

The best conversation I had was when the vet said “using ours allows liability coverage, if he gets heart worms we would cover it through the medical provider” - however it can seem like just another overused sales pitch for some. I know I paid \$250 more for a neuter once with all the “additional testing” plus my vet requires a \$50+ exam fee even if my dog doesn't

get all the exams. I don't blame people for thinking heart worms are just another thing to be overcharged for

It is difficult to get my veterinarian to fax a prescription to online pharmacy. They refuse.

There are cheaper methods than listed

Unfortunately multiple things that aid in the animals general health are not available without a vet. Adding larger costs for something that should be more adorable if it was the animals well being not the vets well being in mind.

Since Covid, the vet tech comes to the car to get the dog. I have minimal to no interaction with the vet

Make it OTC

Some heartworm preventative is not working the way it should. For example heart guard is known in the vet world to be one of the preventatives that dogs are coming back positive even if they have been on it for years.

Thank you for doing the survey! Heartworm is a horrible, preventable illness that more owners should be aware of. I have always had Great Danes and made sure they got their monthly dose.

I asked my vet but they said it's not a concern, I'm in Southern California- that may explain it

My daughter took in a dog that heart worms. We learned a lot at that time about it. Although prevention is costly so is the treatment. Luckily it's been 7 years and he's still going strong. The treatment saved his life.

I had a dog I adopted from the island of Antigua where nearly every dog has heartworms. She was positive. Luckily there was no obvious damage and she was able to be treated once in the states. Treatment is very expensive and it's hard on dogs. It was sad not to see her be able to run for quite a while. I wanted to share my own experience of having a heartworm positive dog and going through treatment.

Would like to know other opinions about heartworm protection in our state of AZ

Figure 6. Direct, unedited feedback from participants at the end of the survey. Comments not relevant to the research have been excluded from this list.

Analysis

The hypothesis was that the lack of heartworm prevention use is due to lack of communication between the client and veterinary professional both on the overall discussion of heartworm existence and the clients understanding of the large risk they can pose to their pets' health. The overwhelming majority of participants (96.6%) had been educated by a veterinary professional and, as figure 1 shows, a relatively low number of participants did not agree with the statement of understanding why prevention was being recommended and how/when to administer it at 11.1% and 7.7% respectively. However, there is a disconnect between participants answer on whether or not they understood how and when to give prevention and the reality, which can be measured by their answer to the fill in the blank question of how often to give oral/topical prevention. Only 7.7% of respondents reported not knowing how/when to give prevention, but over double that number answered the question incorrectly (15.7%) and fifteen participants elected not to answer this question, leading one to believe that they did not know how to respond. This means it could be concluded that up to 25% of participants did not know how often to give prevention. This indicates client confusion; the veterinary professional may have said one thing, but the client heard something different and believes their pet is fully protected, when in reality they are not.

Eighty-three point eight participants responded "yes" they give heartworm prevention, but when the products they reported administering are analyzed it is seen that 20.5% of those respondents are only giving flea and tick prevention. Many of the participants in this category ranked the importance of giving heartworm prevention at a ten out of ten. These respondents believe that they are protecting their pet from heartworm disease, but that is not the case. This

leaves only about 60% of participants pets actually receiving heartworm prevention. It can be concluded from this data that veterinary professionals are doing an excellent job of bringing up the topic of heartworms to their clients, but the effectiveness of the discussion can be improved.

Client confusion about how and when to give prevention can lead to misconceptions that heartworm prevention is not effective. When participants who do not give any heartworm prevention were asked for a rational 13% indicated that they do not believe heartworm prevention is effective. If the clients pet tests positive for heartworms they believe it was due to the medication being ineffective when in reality it was being administered incorrectly or not at all. This begins a domino effect of miscommunication and in some instances leads the client to believe the veterinary practice is only sees heartworm prevention and testing as a means to make a profit. Evidence of this thought can be seen in figure 5.

Ten point four percent of participants only give heartworm prevention during the warm months of the year. According to the data collected, about 30.4% of clients that do not give year-round prevention use low risk of infection as a rational. It is not clear from the data collected what level of understanding the clients have about their pets' risk of infection. Many clients perceive their inside dogs' risk to be low enough that the expense or inconvenience of prevention is not worth it, and while indoor pets' risk may be lower than an outdoor pet, there is still a chance of infection.

About one fourth of participants whose dogs do not have an annual heartworm test done responded that they decline the annual heartworm test. The overwhelming majority

indicated in short-answer format that they do not believe it is necessary if their pet is on heartworm prevention. As mentioned, about 20% of respondents who indicated that they give heartworm prevention are only giving flea and tick prevention and an additional 22.2% do not give prevention twelve months out of the year. The pets of these participants are left vulnerable to heartworm disease with or without client knowledge. Heartworm disease is not recognized until some degree of permanent damage has been done to the heart muscle, so annual testing is highly recommended.

Analysis of the survey results revealed the following major barriers to pets receiving heartworm prevention: client confusion, forgetfulness, and finances. Since up to 25% of participants do not know when and how to give prevention and 20% believe they are giving heartworm prevention but are not, a large barrier to pets receiving prevention is client confusion. Client forgetfulness is also prevalent with 53.8% of participants indicating they forget to give prevention and/or forget to buy prevention on a select-all-that-apply question. Finances also play a role for some clients with 34.7% of participants listing it as a rationale for their pet not receiving any prevention.

Conclusion

Veterinary professionals are doing an excellent job of broaching the topic of heartworm prevention with their clients, but survey results indicate that either the quality of the conversation or the level of client understanding can be improved, or both. A trip to the veterinarian can be stressful for pets and clients whether it is due to bad memories, the hassle of transporting a pet, finances, or otherwise. This stress can cause important information to be

missed by the client. Clients are only exposed to this onslaught of potentially overwhelming information one time per year. Topics can include when to spay or neuter, changes in health seen on physical exam, and other preventatives in addition to any concerns the client has when bringing their pet in. It is easy for the information about heartworm prevention to go in one ear and out the other. Clients should be exposed to this information in more ways than one and more times than once. This includes having the entire veterinary team participate in education from the first face they see when checking in to the technician and veterinarian.

A study performed by Partners for Healthy Pets using five years of compiled data from surveys of pet owners and veterinary staff indicates that pet owners do not always understand what the staff believes they are communicating to them. Communication is arguably the most important aspect of veterinary medicine and inadequacies in this area cause many pets to go without prevention. The twenty percent of clients who believe they are giving prevention but are in fact only administering flea and tick prevention are an example of inadequate communication with the veterinary team. Clients should be aware of the products they are giving their pets and it is the veterinary professionals' responsibility to help them navigate the overwhelming amount of product options to select products that are appropriate for the patient. Receptionists should be aware of the products that their practice carries and what parasites they cover so they can assist clients during checkout and educate the clients who are only purchasing flea and tick preventative.

Receiving information auditorily can only go so far, especially when the amount of information is large, and the topic may be foreign to clients. Placing visual client education tools in exam rooms such as a chart displaying different types of heartworm prevention, a model

heart infected with parasites, or a poster with disease prevalence in the area can improve clients understanding and help them see how serious heartworm disease is. Another low-cost option to expose clients to this information is to post information or even do trivia about heartworms on social media pages. It may also be helpful to send clients with a pamphlet explaining what was discussed and that highlights important take-aways so that they are relieved of trying to remember everything that was said and can digest the information at a later time or discuss it with co-owners. The more times and ways clients receive this information the better they will understand and the more likely they are to remember to give prevention.

It is important for veterinary professionals to remember to give clients all the information about why they are recommending heartworm prevention. Clients are more likely to comply if they understand the why behind the cost and inconvenience. It can be easy to simply state that prevention is recommended and once the client agrees move on to another topic. This same premise applies with heartworm testing, if it is offered and the client declines it is easiest to end the conversation there. However, veterinary professionals need to ensure clients understand what they are declining or why they are agreeing to give a medication. If a client quickly agrees to give prevention but does not understand why it is important it is much easier for them to discontinue use for any of the reasons mentioned such as perceived risk of infection, expense, or inconvenience without fully realizing the implications of their decision. If the veterinary professional has not discussed their pets risk level the client is left to their own devices to determine what they believe the risk to be. A client that agrees without being given all the information may purchase a dose when prompted, but never return for the next month's

dose. Clients should be made aware of what end-stage heartworm disease looks like, the expense of treatment, and a realistic idea of their pets' risk of infection. It is the responsibility of the veterinarian to make sure clients can make an educated decision about their pet's health, regardless of what that decision may be.

It is worth noting that communication between the veterinary professional and client was severely impeded during the COVID-19 pandemic. Many veterinary clinics were offering only curbside service and face-to-face interaction was strictly limited. This period lasted for a minimum of six months and up to over a year for some locations. New pet owners may have missed a critical period in forming a relationship with their veterinarian. Most communication during this time was happening over the phone which is inhibitory due to the loss of non-verbal cues. Since keeping a distance from clients was a necessity during this time, important information such as the heartworm prevention discussion may have been missed. This lapse of in-person communication heightens the need to discuss heartworm prevention with all canine owners regardless of the number of previous visits or assumed knowledge. Many clients still elect to continue curbside veterinary services either for safety or convenience. Veterinary professionals should be ensuring that these clients are still receiving the same level of education that would be given in an exam room.

Expense of heartworm prevention and testing was a common barrier for clients getting this care for their pet. Unfortunately, changing the cost of procedures and medication is not a feasible solution. A step that can be taken to help lower this barrier is education about the cost of owning a pet. Many people do not consider this expense, or veterinary expenses in general, when purchasing a pet. Lifelong heartworm prevention is an investment in the health and

longevity of a canine companion, just as any other preventative measure. In some cases, once clients understand how important this medication is they can justify the cost. A veterinarian is well versed in accommodating client budget into providing care for a patient. Simply identifying this barrier can go a long way in helping a pet get the best care within a budget as opposed to no care. Communication and education are the veterinary professionals' only practical tools to combat the barrier of expense.

Forgetfulness is perhaps the most straightforward and easy to remedy barrier. A monthly responsibility can be difficult to remember for clients with busy lives. Veterinary professionals have several options to help clients overcome this barrier to consistent protection. The practice can post reminders on social media, recommend putting reminders on smartphones and calendars, and inform clients of reminder programs. Many heartworm prevention manufactures offer programs that will remind clients to give prevention with a text or email. When clients share their struggle with forgetfulness, it is a great opportunity to educate them on why annual testing is so highly recommended.

Veterinary professionals want to protect as many canine patients as possible from the fatal parasite *dirofilaria immitis*, but the only way is through client cooperation. Three main causes of client non-compliance have been identified to help veterinary professionals see where they are lacking in terms of getting patients on prevention. Many of these barriers are not unique to heartworm prevention but are encountered in almost every aspect of veterinary medicine: expense and client misunderstanding. Speaking honestly and frequently with clients and checking their understanding is the only way to overcome these barriers. Heartworm disease can be complex and difficult to understand, especially for a client, but taking the time

to ensure their understanding will pay off with prevention compliance and fewer patients diagnosed with heartworm disease.

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Appendix A

Informed Consent Document

Thank you for taking the first step to participate in the undergraduate research of Emily Fischels! This survey will be used to investigate the use and understanding of heartworm prevention in dogs. Participation in this study is voluntary. You are free to leave questions blank or exit the survey at any time with no fear of repercussions. Please answer the questions honestly, there will be no judgement of answers perceived to be “right” or “wrong” by the investigator or involved parties. Participants will remain anonymous; no identifying information will be collected. However, the investigator cannot guarantee confidentiality or eliminate all possibility of risk through an online survey platform.

Participation in this study may not benefit you directly, but it will help veterinarians better serve pets and their owners by understanding the barriers to pets receiving consistent heartworm prevention.

This research is overseen by Dr. Laura Ken Hoffman assistant professor at Murray State University as well as Honors College Executive Director, Dr. Warren Edminster.

If you have any questions or concerns about this study, please contact:

Primary investigator: Emily Fischels (efischels@murraystate.edu)

Faculty Advisor: Dr. Laura Ken Hoffman (lhoffman2@murraystate.edu)

Appendix B

Survey Questions

By checking "I agree", you are acknowledging that you understand your above rights AND that you are 18 years of age or older. *

I agree

Are you the primary caretaker of at least one dog?

Yes

No

Are you a student or alumni of the MSU Veterinary Technology Program or are you employed/formally educated in the field of veterinary medicine?

Yes

No

Has your dog(s) been seen by a veterinarian in the past year?

Yes

No

Is your dog(s) 6 months of age or older?

Yes

No

How many dogs over the age of 6 months do you have?

Has a veterinary professional (veterinarian, technician, receptionist, etc.) ever talked to you about heartworms/heartworm prevention?

Yes

No

If so, which professional?

Veterinarian

Veterinary technician: usually the individual in scrubs who you first speak with in the room

Receptionist

Unknown

Other:

If yes, please select the most correct answer to the following statements.

I left the conversation with a full understanding of why heartworm prevention was recommended.

- Strongly Agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree
- N/A

I left the conversation with a full understanding of when and how to give heartworm prevention.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly Disagree
- N/A

If a veterinary professional has never spoken to you about heartworm prevention, were you already aware of it before taking this survey?

- Yes
- No
- N/A

How important do you feel giving heartworm prevention is?

- Extremely unimportant
- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- Extremely important

Is your dog(s) on heartworm prevention?

- Yes

No
Unknown

Please check all products that your pet is on for heartworm and/or flea and tick prevention.

Trifexis
Nexgard
Heartgard
Comfortis
Advantage Multi
Frontline
Frontline Plus
Interceptor Plus
Simparica
Simparica Trio
Proheart 6
Proheart 12
Revolution
Sentinel
Bravecto
Other:

Please indicate how often oral/topical heartworm prevention SHOULD be given

I strive to give my dog heartworm prevention... *either by giving monthly preventative or by Proheart injections given by a veterinarian*

Year-round
Only during the warm months of the year
I do not give heartworm prevention
Other:

My pet actually receives heartworm prevention ____ months out of the year

If your pet does not receive any heartworm prevention, why is that?

The prevention is too expensive
I am not aware of the need for prevention
My dog does not go outside or goes out only to use the bathroom and therefore cannot contract heartworms
I am aware of heartworms and do not believe prevention is effective

I am aware of heartworms and do not believe they would negatively impact my dogs' health if contracted

N/A

Other:

If your pet receives some heartworm prevention but not 12 months out of the year, why is that? Select all that apply

I don't believe it is necessary in the winter/cooler months

I forget to give prevention

I forget to buy prevention

Other:

Does your dog receive an annual heartworm test?

Yes

No

Unknown

Sometimes

If not, why is that?

I decline the annual heartworm test

I have never been offered a heartworm test for my dog

My dog has not been to the vet's office

If you decline the annual heartworm test, please explain why

Would you like more information about heartworms and how to protect your dog?

Yes

No

Would you like to add anything?

Please speak to your veterinarian about any questions related to your dog's health including heartworms and heartworm prevention. Thank you for participating in my research!

Appendix C

IRB Approval



Institutional Review Board

328 Wells Hall
Murray, KY 42071-3318
270-809-2916 • msu.irb@murraystate.edu

TO: Laura Hoffman, Animal Health Technology
FROM: Jonathan Baskin, IRB Coordinator *JB*
DATE: 9/21/2021
RE: Human Subjects Protocol I.D. – IRB # 22-021

The IRB has completed its review of your student's Level 1 protocol entitled *Barriers to Client Compliance and Understanding of Heartworm Prevention in the Canine Patient*. After review and consideration, the IRB has determined that the research, as described in the protocol form, will be conducted in compliance with Murray State University guidelines for the protection of human participants.

The forms and materials that have been approved for use in this research study are attached to the email containing this letter. These are the forms and materials that must be presented to the subjects. Use of any process or forms other than those approved by the IRB will be considered misconduct in research as stated in the MSU IRB Procedures and Guidelines section 20.3.

Your stated data collection period is from 9/21/2021 to 12/10/2021.

If data collection extends beyond this period, please submit an Amendment to an Approved Protocol form detailing the new data collection period and the reason for the change.

This Level 1 approval is valid until 9/20/2022.

If data collection and analysis extends beyond this date, the research project must be reviewed as a continuation project by the IRB prior to the end of the approval period, 9/20/2022. You must reapply for IRB approval by submitting a Project Update and Closure form (available at murraystate.edu/irb). You must allow ample time for IRB processing and decision prior to your expiration date, or your research must stop until such time that IRB approval is received. If the research project is completed by the end of the approval period, then a Project Update and Closure form must be submitted for IRB review so that your protocol may be closed. It is your responsibility to submit the appropriate paperwork in a timely manner.

The protocol is approved. You may begin data collection now.

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afforded*

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