

AN ABSTRACT OF THE THESIS OF

Jennifer Lam for the degree of Master of Science in Marine Resource Management presented on August 5, 2014.

Title: Dose of Reality: What Can We Learn from Educational and Veterinary Pet Owners to Guide More Effective Environmental Stewardship of Pharmaceutical and Personal Care Products (PPCPs)?

Abstract approved:

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Improper disposal of unused human and pet pharmaceuticals and personal care products (PPCPs) are an emerging public and watershed health threat around the world. Although some waste stream reduction programs such as PPCPs “take-back” exist, there is limited research in current programs on reducing the entry of PPCPs into the environment that focuses on what motivates people - specifically pet owners - to take stewardship actions with their pet PPCPs.

To fill this knowledge gap, an online survey was conducted with veterinary care professionals and educational pet owners on the West Coast to first understand the motivations for pet ownership and the environmental desires for their pets and how aware pet owners are of the connections between PPCPs and the environment. Once pet ownership patterns were established, the connection between pet ownership and use and disposal of pet PPCPs was examined. Pet PPCP use and disposal status was

then correlated with the respondents' use and disposal of human PPCPs. With this data, the study then observed how the HCAM (Human Capacity to Act Model) framework of applying rational choice, social proof, and institutional choice theories might be used to explain the triggers to PPCPs use and disposal behaviors/actions.

Overall, the findings from this research shed light on the current status in use and disposal of pet PPCPs and indicate a positive relationship between the disposal of human and pet PPCPs. The study found that a majority of unused PPCPs are disposed of in the garbage or simply stored in households. For the most part, the pet-owning educators and veterinary care professionals in this study responded similarly, but differences did exist. Veterinary care professionals were driven more by economic factors, while educators were influenced more by environmental motivations. We examined how to understand some of the drivers and outcomes to this emerging contaminant issue in the environment through the HCAM framework to improve communication with stakeholders that can lead to more effective programs, studies, and policies on PPCPs stewardship.

Keywords: pet owners, pets, pharmaceuticals, personal care products, PPCPs, environmental stewardship, behavior change, rational choice, social proof, institutional choice, veterinary care professional, educators, human capacity to act model, HCAM

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Guide More Effective Environmental Stewardship of Pharmaceutical and Personal
Care Products (PPCPs)?

by
Jennifer Lam

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I understand that my thesis will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my thesis to any reader upon request.

Jennifer Lam, Author

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Dose of Reality: What Can We Learn from Educational and Veterinary Pet Owners to Guide More Effective Environmental Stewardship of Pharmaceutical and Personal Care Products (PPCPs)?

CHAPTER ONE: GENERAL INTRODUCTION TO THIS RESEARCH PROJECT

Pharmaceuticals and Personal Care Products in the environment

Increasing human activities and their impacts on natural environmental variations have direct and indirect effects on the ecosystem (McLeod & Leslie, 2009).

Pharmaceuticals and personal care products (PPCPs) are emerging contaminants of growing concern in watersheds and drinking water (Daughton & Ternes, 1999).

Examples of PPCPs include prescription and over-the-counter drugs, veterinary drugs, cosmetics, and fragrances. Studies have shown that the worldwide annual per capita consumption rate of pharmaceuticals is 15 grams, but it is actually three to ten times higher in developed countries (50-100 grams) (Zhang, Geißen & Gal, 2008). One pathway of PPCPs contamination into the environment is through human-mediated improper disposal of unwanted or expired medication used in veterinary medicine and human health care. The increased levels of emerging contaminants in the environment are putting the ecosystem at risk, with problems ranging from degradation of water quality to negative impacts on aquatic organisms.

Currently, growth in the coastal, rural, and suburban populations are continuing to increase thereby, leading to more sewage and disposal of PPCPs. Water treatment plants are a large filter for much of this sewage. However, new classes of medications emerge frequently and the existing treatment plants are not designed to filter or remove these chemicals or new PPCPs. Additionally, these water treatment plants are typically ill-

equipped to deal with the synergistic effects of hundreds of PPCPs coming through the system. This is important to consider because the environment can especially be sensitive to these synergistic effects, especially estuaries as they hold many aquatic organisms. For example, a study conducted looking at synthetic musk ingredients found in the coastal and estuarine environment of the United Kingdom detected bioaccumulation levels that could impact both marine and estuarine species (Sumner et.al. 2010). There is concern that if no action is taken on PPCPs in the environment and the impacts on aquatic organisms, the effects may be too robust to reverse in the future (Daughton & Ternes, 1999). Therefore, taking a systems approach rather than focusing on one chemical is one way to create a holistic and integrated management plan for addressing these emerging contaminants in the environment due to the synergistic impacts in the water.

Current programs on reducing the entry of PPCPs into watersheds are directed towards encouraging actions such as voluntary take-back programs and not flushing unused medication; yet these actions are typically only used by a small segment of the eligible population. Actions that deal with reducing PPCPs accumulation in the household can help lead to reducing amounts going into the environment (Ruhoy & Daughton, 2008). There is, however, limited research on what motivates people to take stewardship actions with regard to PPCPs disposal and unless proper actions are taken, the quantity and sources of PPCPs reaching our waterways will continue to increase.

Research Needs/Gaps

Although there is a growing body of monitoring and research on the water quality, occurrence, and the ecotoxicology effects of PPCPs in the water, and disposal programs,

there is a paucity of research on the human and societal behaviors of PPCPs stewardship and why there is even a need for disposal programs (Figure A). This study begins to fill in this gap and improve our understanding of pet ownership, pet PPCPs, pet owner attitudes, norms, knowledge, and the “triggers” leading to behaviors on use, flow, and disposal of PPCPs. This study does this through the exploration on the influences of institutional choice, social proof, and rational choice in guiding human actions. By examining how and why pet owners acquire, use, and dispose of PPCPs, we can understand some of the drivers and outcomes to this emerging contaminant issue in the environment and use this understanding to improve communication with stakeholders and create more effective programs, studies, and policies related to PPCPs stewardship.

Additionally, this research sought to understand if there is a relationship between use and disposal of pet and human PPCPs. For example, might the use and disposal actions with regard to pet PPCPs mirror behavior with human PPCPs? Therefore, by looking at pet and human PPCPs use and disposal, it might allow us to be proactive in pollution prevention rather than respond reactively and then have to remediate and restore (Daughton, 2004). By proactively addressing pet PPCPs use and disposal, we may be able to help prevent a problem before it occurs and this might save time, money, and effort in the end.

Much of the current research is on monitoring the presence of PPCPs, the ecotoxicology of PPCPs in the environment and on education and outreach. This study, on the other hand, focuses at the “human dimension” source of the problem and works on prevention and precaution to reduce the effects on the environment and can further increase on accountability (Daughton, 2004). By integrating the theories of rational

choice, social proof, and institutional choice in this scenario, it can also be a basis for research and stewardship programs in other areas that look at understanding human behavior change to encourage positive environmental stewardship.

Research Rationale, Target Audience, and Approach

Pet owners who were in the professions of veterinary care or education located in Washington, Oregon, and Southern California were chosen as the target audience for this research project for several reasons. Sixty-two percent of American households include at least one pet, and that 63.2% of pet owners consider their pets to be family members (HSUS, 2012; AVMA, 2012). With such a large amount of pets in U.S. households there comes an increase of pet PPCPs use and disposal.

There is also a social function to being a pet owner. A pet owner who walks his or her dog often meets other dog owners and a social network can be created between people who share similar interests. In this case, pets can be seen as social enablers and providing opportunities to network (Rikjken and Beek, 2011). These social networks might then help influence pet PPCPs decisions. In addition, there is evidence that companion animals can be a benefit in pet owner health (Headey, Na, & Zheng, 2008). By having a close attachment and physical presence with pets, it can be linked to better health and social capital and increase pet ownership value.

Pet owners invest in their pets. The average veterinary expenditure per household for all pets in 2011 was \$375 (AVMA, 2012). Veterinary visits not only result in information exchange and care, but they also result in an interaction with pet owners and veterinarians. Therefore, veterinary care professionals were chosen as one of the sub-

population of the pet owners. Veterinary care professionals have the one-on-one conversations with pet owners and may or could be passing information about use and disposal of PPCPs. In 2011, the Illinois-Indiana Sea Grant program partnered with the American Veterinary Medical Association (AVMA) to develop a set of medication management steps for veterinarians to share with their clients; they also collaborated on a public service announcement on reducing improper PPCPs disposal that aired on a JumboTron in New York City's Times Square Plaza for two months (Kammin, 2013). Given that a large network of veterinary care professionals in AVMA are already being exposed to proper disposal methods of pet PPCPs, it seemed appropriate for this study to connect to some of these veterinary networks in order to gather information for this study. Therefore, one target audience for this study was pet owners who are part of the veterinary care occupation, which included practicing veterinarians, veterinary school students, and allied veterinary care staff (technicians).

Educators who owned pets were the second target audience in this study. Formal educators have institutional connections to the younger generation and may be able to pass on information on PPCPs stewardship through classroom interaction. Informal educators (often associated with museums, libraries, zoos, and non-profit organizations) may or may not be interacting with youth and families in the formal classroom setting, but they also might have opportunities to pass on information concerning PPCPs stewardship.

This study engaged these two audience groups via an online survey. The rationale behind our work can be linked to an evolving model called HCAM, the Human Capacity to Action Model. We have developed HCAM through this study as a framework for

integrating how three theories (rational choice, social proof, institutional choice) can be applied to better understand specific influences on human behavior change (Figure B). In simplest terms, the HCAM framework is an avenue to explore factors influencing human capacity for behavior change. Framing issues in the context of HCAM can provide guidance to creating effective educational outreach and engagement to address emerging contaminants in the environment and focus on pollution prevention.

HCAM, Related Components, and its Connection to this Study

Rational Choice

The theory of rational choice incorporates the idea that knowledge influences informed decisions, and that an individual will expect the consequences of each action option and will determine which decision will be the most beneficial for them (Scott, 2000). For example, a person might read in the newspaper (or see on the news) that antibiotics they had used and disposed of were entering the waterways. As they read on, they see that these antibiotics might be causing potential evolution of antibiotic resistant strains of soil and aquatic bacteria that can increase their risk to infections. Rational choice theory asks the questions: “Would this knowledge trigger people to reduce their use of antibiotics?”

One well-known illustration of rational choice is the connection between planned behavior and personal norms. For example, Ajzen (1991) reflects that the intention of an individual to perform behavior might be linked to motivational factors and that these motivational factors can show how much an individual is willing to change a specific

behavior. These motivational factors can be either external (physical) or internal (mental) (Satz & Ferejohn, 1994).

Social Validation, Social Proof, Social Norm

The theory of social validation incorporates ideas on social proof. According to Cialdini (2007), social proof is “when we are uncertain about what to do, we look to other people to guide us. And we do this automatically and unconsciously” (p. 114). For example, a consumer in the community might be engaged in order to provide information about the social acceptability of the outcomes of a procedure, the procedure itself, or even the goals of a procedure (Francisco & Butterfoss, 2007; Kazdin, 1977). From this point of view, a change in behavior might be seen not as due to an individual’s will power, but rather due to a group effort (Rowson, 2013). The result is that there is a sense of satisfaction when one is validated socially and this can lead to positive behavioral outcomes.

It is, however, important to distinguish the difference between decisions made because of social norm and social proof. An example of a social norm in the United States is walking on the right side of the sidewalk because this is what society deems as “normal”. Most people (almost unconsciously) walk on the right side of the sidewalk. An example of social proof might be observed regarding the wearing of a hat inside a building. For instance, in Texas, many people wear cowboy hats and in many places. A decision influenced by social proof might be observed in a situation where someone walks inside a church and leaves his hat on until he notices that others are staring at him because they removed their hats, so he then removes his hat as well.

In the context of this study, might it help to change “social proof” because it could then focus attention on a different behavior (such as “proper” disposal methods and pollution prevention)? Community participation and creating a sense of social proof might encourage behavior change to avoid PPCPs contaminants from entering the environment.

Communities tend to look for change to deal with big and small problems that can lead to a better life (Andreasen, 2006). Promoting sustainable environmental behaviors by the community might lead to more individuals willing to accept and act similarly. Socially important tools/connections such as social marketing and consumer peer pressure might influence the cost and benefits of adopting a behavior and the idea of self-identity (Andreasen, 2006). By linking the influence of rational choice with the theory of social proof, one may better understand this perspective as a driver of behavior change.

Institutional Choice

Many of the decisions that people make every day are driven by institutional policies and regulations, where the behavior is chosen and/or controlled by the “system” (Anderson, 2013). Laws are in place and for the most part, people follow them to avoid being fined or getting in trouble. When making institutional choices, it is easier for people to change behavior because there are few choices to select from and thus quickly can become habits (Anderson, 2013). For example, take the concept of seat belts - there is not a choice that for an extra \$200, a person would decide to get seat belts added as an option to their new car. The system has already built this into every new car that is for sale; a person does not have a choice in the matter. Additionally, because the law states

that seatbelts must be worn, if a person chooses to not use a seat belt there is a likely chance they could be penalized. Therefore, most people use seatbelts. This example shows that it can be easy for a person to change their behavior if the institutional system has an influence on their decision-making.

An example of a current PPCPs institutional policy is through the Environmental Protection Agency (EPA). They have developed a four-prong approach that includes strengthening science, improving public understanding, building partnerships and promoting stewardship opportunities, and taking regulatory action when appropriate (EPA PPCPs, 2013). When describing strengthening science, importance is placed on having a strong foundation in data collection and research methods when looking at PPCPs in the environment. The EPA has several methods and occurrence studies surrounding this issue, as well as research questions to answer key impact effects of PPCPs on aquatic life and human health risk (EPA PPCPs, 2013). Improving public understanding is linked with building partnerships and promoting stewardship opportunities and, in doing so, research and science can be communicated to the community. When appropriate, the EPA uses regulatory tools such as preliminary studies and contaminant lists to minimize PPCPs entering the environment (EPA PPCPs, 2013). By having federal, state, and local industries play a part in extending the information to the public, people may become aware and more knowledgeable about the issue and take action.

Another agency taking action on the concerns of PPCPs in the environment is the Drug Enforcement Agency (DEA). The DEA has put forth a National Take-Back Initiative, where local law enforcement agencies participate in an annual collection event

for unused or expired pharmaceuticals (DEA 1307, 2014). In 2010, the DEA amended the Controlled Substances Act to provide for the take-back disposal programs. Formally called the Secure and Responsible Drug Disposal Act of 2010, this amendment was issued to primarily address the issue of drug abuse and accidental poisoning with controlled substances. It also addresses future applications and goals of what public and private entities can do to tackle the PPCPs issue (DEA Controlled Substances Act, 2010). Though the DEA does not emphasize the environmental impacts of pharmaceuticals and controlled substances in the water; rather they continue to focus on the human risk area, putting forth regulation and plans to help reduce drug abuse and accidental poisoning.

HCAM - Compassionate Systems

Ruben Anderson, a behavior change and sustainable systems consultant in British Columbia, talks about the idea of compassionate systems as an approach to deal with the “frustration and failure of behavior change” (Anderson, 2013, lecture). The most ignored fact, according to Anderson, is that the brain has limited attention. For example, a person might watch 20 commercials or read 15 advertisements in magazines, but what will this person take away from all of that? Are these commercials and advertisements actually communicating motivations or decision options that will initiate a change to the person’s behavior? Anderson believes that a failure of creating change occurs with this approach. Rather, “compassionate systems” works with people and their brains to support different behavior, so that there does not need to be extra thinking or deciding involved.

According to Anderson, our biggest flaw is that “we think our mind controls our behavior, but in fact we are social creatures, not rational” (Anderson, 2013, lecture). He

believes that we live in a world that is built for rational people, so when we don't do something that is socially expected, we often get blamed or labeled as not caring. "Compassionate systems" on the other hand recognizes human limits and accept that people can only do so much based on the influences around us. Anderson nicely puts it as, "our attempts to create change often carry an undercurrent of blame—You need this app because you are lazy; We need better sound bites because you don't care; You need this website because you are ignorant—but the data shows people aren't the problem, bad systems are" (Anderson, 2013, lecture).

This study investigates the influences on decision-making regarding PPCPs. Instead of asking people to pay attention to what PPCPs they are buying and to do this or do that, we look into the influence of society and how the system can change, not the individual. Previous research has shown that 95% of behavior is social, while the other 5% is rationally chosen (Anderson, 2013). By focusing on the influence of social proof on decision-making about PPCPs stewardship and behavior change, might there be an increase in effectiveness with community engagement?

Anderson's concept of compassionate systems was divided into three drivers that influence behavior and the capacity of the mind to act on them (smallest to largest): conscious behavior (rational choice), social behavior (social proof), and systemic behavior (institutional choice). By studying these three areas of behavior, Anderson was able to draw some conclusions that might help increase the effectiveness of systems (Anderson, 2013):

- Changing the system will have the greatest impact

- Be strategic about who is asked to think and what is asked for them to think about
- Be skilled in how they are asked to think
- Ask them to think about changing the system
- The last resort is to ask them to think about their own behavior

Anderson's research claims that good research based on rational framing and communications can help increase the effectiveness of that 1-5% of our behavior that is consciously chosen. Community engagement and social norms start to work on the 95% of our behavior that is socially determined (Anderson, 2013).

HCAM (Figure B) combines three theories of rational choice, social proof, and institutional choice into a framework for understanding factors that can influence human behaviors. In this model, rational choice is acknowledged as a "primary trigger" for human behavior. However, compared to social proof and institutional choice, a person may have more limited capacity to act on a suite of rational-based information. It is important to note, however, that many agencies and organizations base their educational outreach and engagement on rational choice. Although education can raise a population's awareness, will this education along without social and institutional drivers support positive behavior change and lead to action?

Education/Prevention

In order to combat the growing issue of PPCPs in the environment, preventative actions can have the most impact. "The ultimate aim of education is shaping human behavior" (Hungerford & Volk, 1990, p. 257). Focusing first and foremost on effective

environmental education would appear to be critical to promote responsible environmental stewardship. Changing human and consumer behavior can be difficult, but the topic of PPCPs can capture people's attention and lead to better understanding of how environment science and protection can work together (Daughton, 2004).

The challenge here is to see education turn into action. The conventional way of thinking in environmental education is that we can change behavior by just giving out information about the issues (Hungerford & Volk, 1990). The assumption in this, however, is that knowledge will lead to awareness and thus motivation for action. However, when viewed through the lens of HCAM, this falls under rational choice and is thus seen as having a low influence for behavior change.

“The challenge lies in a willingness to do things differently that we have in the past” (Hungerford & Volk, 1990, p. 267). Responsible behavior is an important part of decisions to keep PPCPs out of the environment; therefore, HCAM can be a new foundation that looks into how targeted education can lead to the prevention and PPCPs stewardship actions.

“Conscious of our roles as stewards of the world in which we live, notably on behalf of future generations, we must therefore take care in exercising these options. This need to proceed in an ethical manner is expressed in debates concerning the precautionary principle. Although the concept of precaution is not a new one, understanding of the precautionary principle has, with time, come to mean different things to different people and application of the precautionary principle has proven controversial on occasion.The precautionary principle applies to a special class of problems that is characterized by: (1) complexity in the natural and social systems that govern the causal relationships between human activities and their consequences and (2) unquantifiable scientific uncertainty in the characterization and assessment of hazards and risks” (UNESCO, 2005, p. 5).

When it comes to environment and human health, depending on the situation, people are faced with several kinds of decisions. The precautionary principle is a preventative approach to avoid “a substance or activity posing a threat to the environment... even if there [is only limited] scientific proof linking a particular substance or activity to environmental damage” (Cameron & Abouchar, 1991, p. 2). As a guiding principle used in Europe, this approach is being used to consider the likely negative effects of an activity before pursuing the activity. There have been motivating factors to use the precautionary principle as a driver for decision-making because “the perceptions that the pace of efforts to combat problems such as climate change, ecosystem degradations, and resource depletions is too slow and that environmental and health problems continue to grow more rapidly than society’s ability to identify and correct them” (Kriebel et al., 2001, p. 871).

Decision makers who use a precautionary approach often use the following primary questions to help guide discussions and decisions (Myers & Raffensperger, 2006):

1. What do we care about?
2. What are we trying to accomplish?
3. What choices do we have?
4. What is the bigger picture?
5. Do we know enough to act? Do we know so little we must act with caution?
6. Who is responsible?

Decisions related to consumer use and disposal of PPCPs might be influenced by the precautionary principle approach. For example, if scientific research finds a certain

PPCPs product or ingredient as a contaminant in the environment but have yet to document the impacts, consumers can still choose to not use those certain PPCPs in order to avoid any future negative impacts. If a consumer understands from the beginning to end where their PPCPs are ending up, this understanding might lead to more responsible environmental stewardship at a wider level and preventative measures. However, there are criticisms with the precautionary principle being too vague and precautionary and having conflicting definitions (Myers, 2000).

Study Methods and Desired Outcomes

An online survey tool was used to gather information on knowledge, attitudes, concerns, and barriers to use and disposal of PPCPs from pet owners in the veterinary and teaching profession in Washington, Oregon, and Southern California. The methods and findings from this research were designed to provide information helpful in reaching future broader impacts and applications to other classes of emerging contaminants, as well as serve as a model for other research and extension programs designing educational outreach and engagement programs. Research findings are intended to inform design of new and current PPCPs stewardship programs and reduce the amount of PPCPs in the environment. They may, by addressing the best way these audiences capture and act on information, help veterinary and educator networks to foster more effective education and outreach communication to their professional groups. Although the study used pet PPCPs as the basis for the research, we believed that it might also be an opportunity to relate this to the pet owner's use and disposal of human PPCPs as well.

Current PPCPs stewardship programs, such as collection events, might also benefit from these findings as they can be used to improve outreach to the general public. Monitoring efforts might also apply the HCAM more broadly, as research findings from other projects might be disseminated to the public in an effective manner. The use of the HCAM, along with the results of this study, opens a door to the human dimension of PPCPs in the environment and provides a path for others to continue paving to improve PPCPs stewardship.

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Figures



Figure A. Current research efforts and gaps in PPCPs efforts

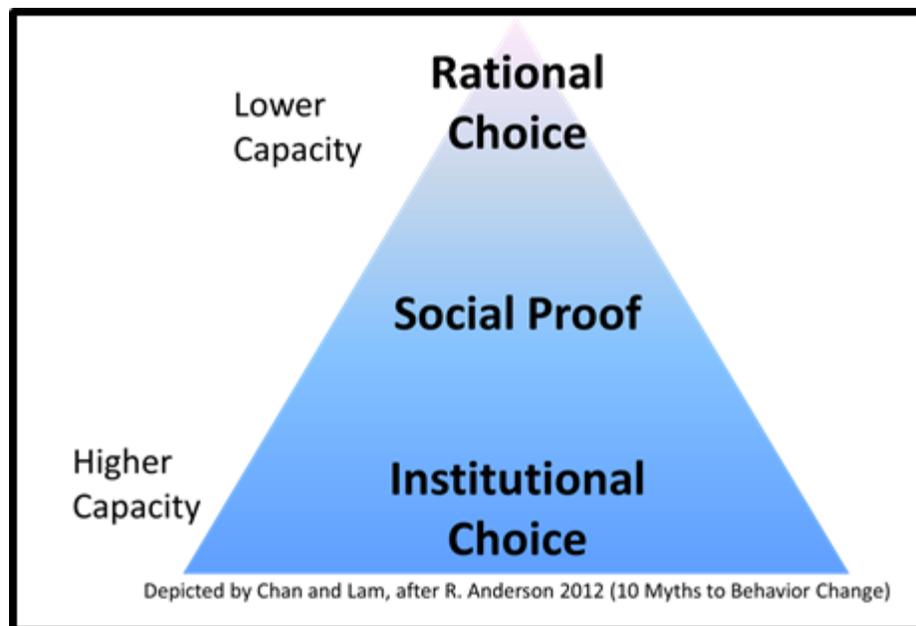


Figure B. Human Capacity to Act Model (HCAM): A framework for drivers to behavior change

CHAPTER 2: HUMAN CAPACITY TO ACT MODEL – EMPLOYING BEHAVIOR THEORY TO UNDERSTAND PET PPCPS USE AND DISPOSAL STEWARDSHIP AMONG VETERINARY CARE PROFESSIONALS AND EDUCATORS

Introduction

Increasing detections of multiple classes of pharmaceuticals and personal care products (PPCPs) in the aquatic environment signals an emerging public health and environmental threat in North America and much of the developed and emerging world economies. Examples of PPCPs include prescription and over-the-counter drugs, veterinary drugs, cosmetics, and fragrances. It is estimated that 40-50% of all prescribed and over-the-counter medications purchased by consumers go unused (Teleosis, 2007). In addition, existing and new classes of pharmaceuticals are produced and prescribed in increasing volumes every year. Since the mid-1990's, an increasing number of studies (Morace, 2012; Boxall, 2012) have documented low concentrations of pharmaceuticals accumulating in watersheds and their acute impacts to aquatic organisms. Much of the current research is on the ecotoxicology of PPCPs in the environment. Although education and outreach programs are in place, the program effectiveness has yet to be researched (Figure A). Yet, there is little research on what motivates people to decide to take stewardship actions when disposing of their PPCPs.

The detection of PPCPs in the environment highlights an increasingly popular research area as the issue comes to the forefront of environmental impacts. A 12-month study conducted in Las Vegas, Nevada examined a coroner office's sewage disposal of pharmaceuticals and classified the pharmaceuticals based on the therapeutic class using the Anatomical Therapeutic Chemical (ATC) system (Ruhoy & Daughton, 2008). Out of the 14 ATC therapeutic categories, the results showed more than 94% of the

pharmaceuticals disposed by that coroner's office represented just five of the categories, leaving opportunity to focus on how these major types of pharmaceuticals can impact the environment (Ruhoy & Daughton, 2008).

PPCPs can cause endocrine disruption that lead to negative effects on reproduction (Luoma, 1999). However, current assay approaches for evaluating reproductive disruption do not fully capture all life stages. By improving research on impacts, monitoring tactics, and PPCPs stewardship education, we can be better informed on emerging PPCPs effects on the environment, where to detect them, and have more effective PPCPs education programs to minimize their risks.

Current educational outreach and engagement programs on reducing the entry of PPCPs into watersheds are directed towards encouraging disposal actions such as not flushing unused medication and participating in voluntary take-back programs. These programs, however, are typically only used by a small segment of the eligible population (M. Taratoot, personal communication, May 2014). Actions that deal with reducing PPCPs accumulation in the household can help lead to reducing amounts going into the environment (Ruhoy & Daughton, 2008).

There is, though, little research on what motivates people to take actions on PPCPs stewardship. Unfortunately, the quantity and sources of PPCPs reaching our waterways will continue to increase unless actions are taken to change how people use and dispose of these materials. Understanding the human and societal behaviors regarding use and disposal of pet PPCPs might help to improve understanding, guide more effective product stewardship, and lead to broader improvements on programs and policy.

Emerging Behavior Theory: Risk Perception

Environmental risk and how people perceive risk can be a factor in how they conceptualize and choose to act on a certain issue. Actions and behaviors are often triggered by certain perceptions and values a person holds. These triggers can be discovered through in-depth research in the area of social thinking and the relative effectiveness of programs focused on rational and/or social choice. Might connecting consumers with the science behind PPCPs in the environment be able to help to facilitate a better sense of awareness of environmental pollution and how their actions impact the effects that follow? Might evaluating how PPCPs users perceive risks and benefits when it comes to PPCPs ending up in the environment help to understand drivers of behavior change?

Risk perception can be seen as what users know and feel about a risk. In an environmental situation, risk perception is the “perceived likelihood of negative consequences to oneself and society from one specific environmental phenomenon” (O’Connor, Bord, & Fisher, 1999, p.462). The “affect heuristic” of certain words, such as “risk”, can carry positive and/or negative connotations and may lead to a reliance on those feelings (Slovic, et al., 2007). These perceptions can often be influenced by personal experience and opinion of others. Perceiving a risk and then taking an action afterwards is often made by considering the options and alternatives. People who see the chance for an unfavorable event are more likely to take personal steps to avoid the negative impacts (O’Connor, Bord, & Fisher, 1999). Risk perception can be observed at different levels, as awareness is selective to what you want to see (Wildavsky & Dake, 1990). Having this perception is often the first step in making a decision, followed by the

contemplation of options and weighing the benefits before finally taking an action (NOAA, 2013). By identifying how people view the actual risk, potential cost and benefits, and then the need for precaution, it may give way to understanding users' knowledge, awareness, and perceptions on PPCPs in the environment, as well as how they make environmental stewardship decisions on facing and/or avoiding risk and weighing the benefits.

Educational programs designed to reduce PPCPs from reaching aquatic ecosystems are based on informing and encouraging consumers to make informed decisions on stewardship practices such as PPCPs take-back programs. This study used human behavior change theories as a basis in this research. Specifically, how rational choice, social proof, and institutional choice drive the decisions of pet owners regarding pet PPCPs use and disposal as well as the use and disposal of human PPCPs. This is important because how people understand, perceive, learn, and make decisions on facing and avoiding risk is an important research element when researching PPCPs disposal.

Study Objectives and Approach

Looking at the source of the problem and how efforts on prevention and precaution to reduce the effects on the environment by increasing accountability might be beneficial (Daughton, 2004). This study uses the theories of rational choice, social proof, and institutional choice as research framework for understanding human behavior on PPCPs stewardship (Figure B).

The focus of this study was to examine an influential subset of PPCPs decision makers (pet owners) and their status of pet PPCPs use, disposal, and stewardship

motivations. The goal was to provide insight into some of the drivers and outcomes to emerging PPCPs contaminants issue, and to provide information that could ultimately improve communication with stakeholders, thereby leading to more effective programs, studies, and policies on PPCPs stewardship.

Pet owners were chosen because 62% of American households include at least one pet, and that 63.2% of pet owners consider their pets to be family members (HSUS, 2012; AVMA, 2012). With such a large amount of pets in U.S. households there comes an increase of pet PPCPs use and disposal.

Lessons learned from both the methods and the findings from this research are intended to have broader impacts and applications to other classes of emerging contaminants. They could also serve as a model for other research and extension programs. Although we used pet PPCPs as the basis for our research, we also believe that this can shed some light on the pet owner's human PPCPs use and disposal. An online survey was used to gather data on participant's knowledge, attitudes, concerns, and barriers to use and disposal of PPCPs, and to stimulate thinking (through open-ended questions and comments boxes). The goal of the study is to ultimately lead to designing new and current PPCPs stewardship programs and reduce the amount of PPCPs in the environment.

To address this, this study first sought to understand the connection between pets and their owners and between PPCPs and the environment. It then looked more in depth into the connection between pet ownership and use and disposal of pet. It then focused on learning how use and disposal of pet PPCPs correlates with the use and disposal of their human PPCPs. With this data, the study then observed how the HCAM framework of

rational choice, social proof, and institutional choice might be used to explain the triggers to their use and disposal behaviors/actions.

1. What are pet owners' motivations for pet ownership and their environmental desires for their pets?
2. What is the status in use and disposal of pet PPCPs?
3. How does human use/disposal of PPCPs correlate with pet PPCPs use/disposal?
4. How does the Human Capacity to Act Model framework explain the triggers to pet owner PPCPs use/disposal behavior and actions?
5. How aware are pet owners of the connections between PPCPs and the environment?

Methods

To do this, pet owners who were in the professions of veterinary care or education located in Washington, Oregon, and Southern California were chosen as the target audience for this research project. Starting in November 2013, key informants provided the initial source of contact for the two subgroups (Marshall, 1996). Veterinary care professionals can have one-on-one conversations with other pet owners and may be passing on PPCPs use and disposal information. Educators were chosen due to their connection to younger generations and families and can pass on PPCPs knowledge. Key informants used included state veterinary networks (such as Southern California Veterinary Medical Association) and regional educator networks (such as Northwest Aquatic Marine Educators, Watershed and Invasive Species Education program) (Appendix B).

In addition to the key informant networks, additional potential study participants were contacted through veterinary student clubs at universities, general online searches of veterinarians, environmental educator networks, and state teacher associations in each county of the target geographic region were contacted. All approaches were critical to identify participants for an opt-in pre-survey (those who were pet owners could self-select to take the survey), and later a general survey. Both survey tools were pre-tested by a twelve-person group (made up of professional veterinarians and educators outside the target audience).

The research protocols which included the participant recruitment process was approved by the Institutional Review Board and started with a ten question, online, opt-in survey (administered via Qualtrics survey software through Oregon State University) that was distributed to the key informant email lists (Appendix B). Only participants who (a) self-selected to participate in the opt-in survey and (b) self-acknowledged as pet owners were assigned a unique code that allowed them to participate in a thirty-two question, online general survey (Appendix C, D, and E). A common definition of PPCPs was provided in the survey to reduce survey response error from inaccurate or imprecise interpretations of the topic.

All potential and later non-respondents (those who opted in but did not complete the general survey) were contacted via standard survey research protocol (Salant & Dillman, 1994). Both the opt-in and general survey process began in November 2013. Data collection ended in May 2014 (n=191). Due to the non-probability sampling, analysis of the data collected is used to infer from the population that participated in this survey. Survey data was analyzed using SPSS Statistics version 21 software. Statistical

analyses (general frequencies, chi-square test, exploratory factor analysis with varimax rotation, reliability test, independent samples t-test, and ANOVA statistics) were used to aid interpretation of the results. Varimax rotation allows for factor groupings from a larger set of variables and the relationships are determined by their loadings. The grouping of individual variables in a factor is based on each factor loading, which should generally be greater than or equal to .40 and eigenvalues should be higher than 1.0 (Tabachnick and Fidell, 1996).

Results

Out of a total of 246 that opted in, a total of 191 general surveys were completed. Respondents from Washington represented 25.6% of the total response, while Oregon and California represented 40.9% and 33.5% respectively.

Respondents from the veterinary care profession included veterinarians, veterinary technicians, and veterinary students and this group represented 62% of the total. The professional expertise of the veterinary care professionals were: companion animal care 81.4%, research 1.4%, and academia 17.1%. The years of experience in the veterinary group were: less than 1 year 12.6%, 1-3 years 23%, 4-6 years 16.1%, and 6+ years 48.3%.

Respondents from the educator profession represented 38% of the total responses. Of these educator respondents, 32% said they were informal educators, while 47% stated they taught in a formal setting. Twenty-three percent said they taught grades 9-12, while 21% taught grades 6-8; however there was more overlap as some of these educators taught a wider range (K-12). Looking at this group through the topic area they taught,

31.3% taught science only, 35.5% taught science combined with other subjects, and 33.3% were non-science/other. The years of experience in the educator group were: less than 1 year 2%, 1-3 years 14.9%, 4-6 years 7.9%, and 6+ years 75.2% (See appendix A for more demographic information via figures).

Pet Ownership and Values

About 71% of the total respondents selected “dog” as their pet to base the survey responses on; 25% indicated “cat” (Figure 1). “Companionship” was the top motivation for acquiring a pet (93%), followed by to “save the pet’s life” (43%) (Figure 2). The top concern these pet owners have for their pet’s well-being was “health/life expectancy” (78%), followed by “cleanliness/hygiene” (57%), and “weight/physical activity” (41%) (Figure 3). When asked what environments they prefer their pet to recreate in, “free-range, clean, and open outdoor spaces” was the top choice (57%), followed by “natural spaces and waterways” (44%) (Figure 4).

When asked about what aspects of these environments make them healthy for their pet, the top environmental aspect was “clean water and air” (60%), followed by “tree and shade” (45%) (Figure 5).

Seventy-two percent of respondents said they purposely bought or considered buying pet personal care products that are designed to be environmentally friendly (Figure 6). For the 28% who selected “no” to this question, 49% indicated that this was due to not being aware of any such products (Figure 7). Open-ended comments indicated that the majority was due to the fact they do not buy any pet personal care products.

Status in Use and Disposal of Pet/Human PPCPs

The status in use and disposal of pet PPCPs were analyzed by descriptive frequencies and converted to percentages (Figure 8-13). Over half of the pet owner respondents stated they used 1 to 3 different types/brands of PPCPs on their pets and that they usually used 3 or less PPCPs on their pet at any one time (Figures 8, 9). Almost 18% California respondents stated 26-50% of their pet pharmaceuticals go unused, compared to 5-6% of Oregon and Washington respondents who selected the same amount (Figure 11a). After calculating the proportion of unused pet pharmaceuticals in the household, a majority selected that up to 25% go unused (Figure 11). Similarly with pet personal care products, the majority selected that up to 25% go unused; however almost a similar amount (43%) say they have no unused pet personal care products (Figure 12).

The correlation between human and pet PPCPs disposal was analyzed with chi-square test after 85% said their “decisions regarding purchase, use, and disposal of pet PPCPs extend to human PPCPs” (Figure 14). To support this statistic, additional questions were asked on the disposal of human and pet PPCPs.

Human PPCPs

The top disposal method for human pharmaceuticals was in the “garbage” (47%), followed by “keep them indefinitely” (38%), and then “return at regular community medicine event” (24%). When each disposal method was assessed by state, more Washington respondents return pharmaceuticals to health care providers (27%), California respondents dispose at regular community collection events (32%), and Oregon respondents keep pharmaceuticals indefinitely (51%) (Figure 15). The top disposal method for human personal care products was in the “garbage” (67%), followed

by “keep them indefinitely” (23%), and then “never have unused personal care products” (23%). When each disposal method was assessed by state, only a small amount of Washington respondents dispose down sink/toilet (7%), compared to California respondents (15%), and Oregon respondents (21%) (Figure 16). Flushing human PPCPs down the sink or toilet accounts for 8-15% and can carry risk with direct impact on the environment (Tables 1, 2).

Pet PPCPs

The top disposal method for pet pharmaceuticals was in the “garbage” (46%), followed by “keep them indefinitely” (22%), and then “return to health care provider” (15%). California had the highest percentage to dispose at regular community collection event (21%) when compared to the other states (Figure 17). The top disposal method for pet personal care products was in the “garbage” (44%), followed by “never have unused personal care products” (27%), and then “keep them indefinitely” (24%). More Oregon respondents keep their pet personal care products indefinitely (31%) than Washington (14%) and California (26%) (Figure 18). Flushing pet PPCPs down the sink or toilet accounts for 5-6%, which is slightly less than human PPCPs (Tables 1, 2).

Disposal methods between human and pet pharmaceutical groups were statistically significant ($p < .001$) for dispose in the “garbage” ($\chi^2 = 42.55$), “keep them indefinitely” ($\chi^2 = 22.06$), “return at regular community medicine event” ($\chi^2 = 48.29$), and “return to health care provider” ($\chi^2 = 15.28$) (Table 3). Disposal methods between human and pet personal care products groups were statistically significant ($p < .001$) for dispose in the “garbage” ($\chi^2 = 46.21$), “never have unused personal care products” ($\chi^2 = 28.37$) and “keep them indefinitely” ($\chi^2 = 15.91$) (Table 4).

Motivations

A principle components exploratory factor analysis with varimax rotation was conducted on the motivation variables to reduce them into broader factors for disposal of pet PPCPs. This exploratory factor analysis grouped the disposal of pet PPCPs stewardship motivations into two factors and all loadings were greater than .56 (Table 5).

Factor 1 included the following variables:

- “desire to avoid risk of accidental poisoning”,
- “desire to avoid risk of misuse/abuse”,
- “desire to minimize pet PPCPs in water”,
- “desire to minimize pet PPCPs in landfills”,
- “follow what's legally required”, and
- “purchase only minimum amount of PPCPs for what my pet might need”

Factor 2 included the following variables:

- “do what's most acceptable to my family and friends”,
- “do what's financially affordable”,
- “go with the flow and do what the majority regard as acceptable”,
- “convenience/ease of disposal”, and
- “heard that it's better to flush pet PPCPs”.

These motivating factors were labeled "environmental" (factor 1) and "personal" (factor 2). Together, these factors explained 52% of the variance in motivations on disposal of

pet PPCPs. Professional motivations may have accounted for the other motivations for disposal.

Motivations on pet PPCPs disposal were measured by asking respondents to respond to eleven statements based on a 5-point scale with 1 being "very unlikely" to 5 being "very likely". The highest average of likeliness in the environmental factors was "desire to minimize pet PPCPs in water" (4.41), followed by "desire to avoid risk of accidental poisoning" (4.33), and then "follow what's legally required" (4.15). As for the personal factors, there was a higher likely agreement for "convenience/ease of disposal" (4.10), while a neutral to likely agreement to "do what's financially affordable" (3.26), and an unlikely to neutral agreement to "do what's most acceptable to my family and friends" (2.35). Indices were computed from these response items and all items were retained in the index because removal of any one of these items would not have greatly improved the overall reliability (Table 6). The overall reliability for environmental factors was .83 and .70 for personal factors using Cronbach's alpha, which indicated a high level of internal consistency for the indices.

Members of both target groups (educators and veterinary care professionals) were more likely to be influenced by environmental factors (4.32, 4.00 respectfully) when it came to disposal of pet PPCPs (Table 7). On the other hand, both educators and veterinary care professionals were more likely to be neutral on the personal factors (2.79, 2.91 respectfully) when it came to disposal of pet PPCPs. The environmental factors for both professions were statistically significant ($t = 3.00, p = .003$).

Influencing Activities

A principle components exploratory factor analysis with varimax rotation was also conducted on the influencing activity variables to reduce them into broader factors for taking positive action for protecting the environment. This exploratory factor analysis grouped the influencing activities into three factors and all loadings were greater than .45 (Table 8). Factor 1 included the following variables:

- “see ads or public notices encouraging me to take action”,
- “government agencies encourage me to take action”,
- “see news media coverage encouraging me to take action”,
- “my professional organization encourages me to take action”, and
- “learn about scientific studies on the consequences of a certain activity and positive actions I can take”

Factor 2 included the following variables:

- “see people I know and trust taking action”,
- “people I know encourage me to take action”, and
- “hear people talking to others about the dangers of not taking action”

Factor 3 included the following variables:

- “financial incentive/reward” and
- “financial penalty”

These motivating factors were labeled "outreach" (factor 1), "social" (factor 2), and "economic" (factor 3). Together, these factors explained 65% of the variance in motivations on disposal of pet PPCPs.

Activities that influence decisions to take positive action for protecting the environment were measured by asking respondents to respond to ten statements based on a 3-point scale with 1 being "no influence" to 3 being "major influence". The highest average for major influence in the outreach factors was "learn about scientific studies on the consequences of a certain activity and positive actions I can take" (2.77), followed by "my professional organization encourages me to take action" (2.43), and then "see news media coverage encouraging me to take action" (2.28). As for the social factors, there was a higher influence for "people I know encourage me to take action" (2.34) (which had a strong effect on the predictive value of the model), followed by "see people I know and trust taking action" (2.33), and then "hear people talking to others about the dangers of not taking action" (2.19). For the economic factors, there was more influence from "financial penalty" (2.35) than "financial incentive/reward" (2.12). Indices were computed from these response items and all items were retained in the index because removal of any one of these items would not have greatly improved the overall reliability (Table 9). The overall reliability for outreach factors was .79, social factors with .81 and .70 for economic factors using Cronbach's alpha, which indicated a high level of internal consistency for the indices.

Both educators and veterinary care professionals were about equally influenced by outreach activities (2.40, 2.37 respectfully). When it came to social activities, veterinary care professionals were more influenced (3.36) than educators (2.32). Veterinary care professionals were more influenced by economic activities than educators (2.33, 2.14 respectfully). The economic factors for both professions were statistically significant ($t = 2.07$, $p = .040$) (Table 10).

Environmental Awareness

Environmental awareness was next assessed where respondents indicated whether they agree, neutral, or disagree to a set of statements:

- “Improper disposal of unused pet PPCPs can threaten the health of our water and the environment”
- “Improper disposal of unused human PPCPs can threaten the health of our water and the environment”
- “PPCPs in air, water, and soil can be a problem for me and my family”
- “PPCPs in air, water, and soil can be a problem for other species of plants and animals”
- "I feel a personal obligation to take action to prevent PPCPs in the environment"
- "Pet waste is a source of pollution in lakes, rivers, and streams"
- “I take positive steps to live an environmentally friendly life”
- “If others don’t take steps to live an environmentally friendly life, then my actions won’t matter”
- "Evidence of native fish being impacted by low levels of PPCPs detected in our watersheds would be a concern to me"

Respondents agreed on all of these statements (>72%) except for “If others don’t take steps to live an environmentally friendly life then my actions won’t matter”, which only 15% agreed (Figure 15). Forty-six percent of respondents stated they were either “very well informed” or “informed” on environmental issues in their state, while 48% were “somewhat informed” and 6% “not informed” (Figure 16).

Needs and Sources of Information

Needs were assessed with the following question: “What would help you to best choose, use, and dispose of PPCPs in a more environmentally responsible way?” The top need was “more environmentally friendly, but effective alternatives” (55%), followed by “drop-off collection boxes” (46%), and then “take back collection events” (37%) (Figure 17).

Sources of information were analyzed in two questions, where they first look for information on pet PPCPs disposal and where they prefer to learn more information. The top three places they first look for information was “read the product information on package” (59%), “recommendation from veterinarian” (57%), and “internet” (47%) (Figure 18). The top 3 places they prefer to learn more information was “health care provider” (57%), “internet” (57%), and “pet PPCPs product label” (51%) (Figure 19).

Veterinary Professional Communication with Clients

Veterinary care professionals were asked 4 additional questions specifically on discussing pet PPCPs disposal methods to clients during appointments, barriers to conveying this information, and solutions to assist them in conveying this information in appointments. Educators were excluded from these questions due to their perceived lack of communication pet-owning clients in a professional setting. Out of the veterinarians that have discussed pet PPCPs disposal in client appointments, only about 18.5% of all appointments are where pet PPCPs disposal are discussed (veterinary students who do not have clients yet were aimed to be removed from this analysis) (Figure 20). In open-ended

responses, veterinary care professionals listed barriers such as lack of knowledge on proper disposal, time, cost, and lack of concern on both client and provider side. When asked what solutions can assist them in conveying this information, the open-ended comments listed actions such as education, better information (i.e. poster, pamphlets), product labels, and convenient place for disposal.

Discussion

Pet Ownership and Values

Pet ownership values, human and pet PPCPs use and disposal, motivations, influential drivers, and environmental awareness were all analyzed from this survey. Companionship was an overwhelming selected motivation for having a pet, bringing up a value these pet owners have on fostering a relationship with their pet, which is similar to other studies on pet ownership values (Staats, Wallace & Anderson, 2008; Lem et al., 2013). By having this companionship appreciation, the concern for health and life expectancy tops the charts for what these pet owners are worried most about. This concern for health indicates possible use of pet PPCPs. When thinking about purchasing environmentally friendly pet personal care products, the majority of these pet owners have thought about it or acted on this, which supports the environmental awareness assessment as well.

Status in Use and Disposal of Pet/Human PPCPs

The status in use and disposal of pet PPCPs were analyzed from the respondents that took the survey. Although many of these pet owners stated that the pet

pharmaceuticals are finished completely and therefore have none to dispose, some also selected that they kept the unused medication until it expires and then they dispose of them. When separating out the professions, educators were more likely to finish pet pharmaceuticals completely (54%), while veterinary care professionals were more likely to keep unused medicines until they expire and then dispose (42%) (Figure 10a). Veterinary care professionals had a higher percentage of unused pet pharmaceuticals than educators, which might be due to veterinary care professionals being able to try and test different pet pharmaceuticals and seeing which ones work best on their pet (Table 11). More educators (29%) have no pet pharmaceuticals go unused than veterinary care professionals (17%), leading to a speculation that educators may follow directions to finish all pet medication that were prescribed versus veterinary care professionals who may do a trial and error with pet medications (Figure 11b). With use and disposal of pet personal care products, over half of the pet owners again said they finish them completely and have none to dispose, but the next popular option for pet personal care products was to store them in the house indefinitely, which would need to lead to some sort of disposal later on. Like use and disposal of pet pharmaceuticals based on profession, educators were more likely to have no pet personal care products to dispose (65%), while veterinary care professionals keep unused pet personal care products until they expire and then dispose (29%) (Figure 12a). Similarly with pet pharmaceuticals, up to 25% of pet personal care products go unused; however, their pet personal care products tended to be used up completely more than pet pharmaceuticals. This indicates a use pattern where leftover pet pharmaceuticals are more frequent than pet personal care products. When addressing the disposal of pet PPCPs, the majority of respondents said that the garbage

was their typical disposal choice (Table 1, 2). This was similar to other literature where garbage was the top method of pharmaceutical disposal (Bound & Voulvoulis, 2005).

Analysis between human PPCPs and pet PPCPs use and disposal found similar disposal methods for both pet and human PPCPs (Table 3). It is interesting to note the respondents that selected “regular community medicine event” was much higher for human PPCPs than pet PPCPs (24%, 12% respectfully). A better perspective to compare this number to is the most recent Benton County, Oregon medicine collection event that occurred in April 2014. There were over 550 pounds of medicine collected from 328 families, but when total families in Benton County are taken into account (18,237), it only shows that less than 2% of Benton County families participated in this collection event (M. Taratoot, personal communication, May 2014). The state of Washington collected 14,992 pounds of unwanted medicines during their 2013 DEA National Prescription Take-Back Day, but only 90 out of 281 cities and towns participated (32%) (Take Back Your Meds, 2013). Similarly, in the 2014 DEA National Prescription Drug Take-Back Day in Vacaville, California, 487 out of 32,814 households turned in 706 pounds of medications, resulting in about a 1% participation rate (City of Vacaville, 2014). Thus, the participation rate for regular community medicine “take back” events among the veterinary care professionals and educators who participated in this survey is many magnitudes higher than public participation.

Results from this study show that educators and veterinary care professionals are more aware of these opportunities and have taken the action to participate in collection options when compared to the general community. An overwhelming majority of respondents acknowledged that their decisions regarding purchase, use, and disposal of

pet PPCPs extending to human PPCPs (Figure 14). This is also supported by looking at the disposal of human PPCPs. After further statistical analysis, there was a statistically significant relationship between human and pet PPCPs user groups based on the disposal methods. The effect size for the relationship on the two groups for “garbage” was "large" or "substantial" and “keep them indefinitely” was between "medium" or "typical" to "large" or "substantial" (Cohen, 1988; Vaske, 2008). The effect size on the relationship of the two groups for “garbage” and “never have unused personal care products” was "large" or "substantial" and keep them indefinitely was between "medium" or "typical" to "large" or "substantial" (Cohen, 1988; Vaske, 2008).

Although there were no significant differences between professions when it came to human and pet pharmaceutical disposal methods, there were some differences in human and pet personal care product disposal between the two groups (Table 12). Veterinary care professionals were more likely to disposal human and pet personal care products in the garbage while educators were more likely to give human personal care products to others and never use pet personal care products. Veterinary care professionals may be more knowledgeable on pet personal care products, hence the higher likelihood of using them compared to educators. In addition, veterinary professionals may have more access to PPCPs and samples, whereas educators may be limited to buying PPCPs at retail.

Motivations

Next, motivations on disposal of pet PPCPs and influential activities on taking positive action for protecting the environment were analyzed to see how the HCAM

corresponds to different drivers for behavior change. These motivational factors can show how much an individual is willing to change a specific behavior. The motivations can be classified as either external or internal (Satz & Ferejohn, 1994). The top pet PPCPs disposal motivation was the desire to minimize pet PPCPs in the water, this could show that the respondents (educators and veterinary care professionals) may have been aware of the issue of PPCPs in the environment and showing up in the water and can be seen as an internal factor (Satz & Ferejohn, 1994). The desire to avoid impacts on the environment along with desire to minimize risk for human health was categorized as “rational choice” in the survey development phase by our research team. This would imply that the respondents would act on this knowledge as a rational decision, and they understand the risk of unused PPCPs to the environment and human health. This understanding would then motivate them to properly dispose of pet PPCPs. When educators and veterinary care professionals’ responses were separately analyzed for this question, there was a statistically significant relationship between these two professional groups on the rational choice responses, leading to professional influences (Table 7). The effect size for the environmental factors was between "small" or "minimal" to "medium" or "typical" (Cohen, 1988; Vaske, 2008). Specifically, the statistically significant motivations for educators were by risk of misuse/abuse, minimize PPCPs in landfill, and purchasing only the minimum amount for their pet. Veterinary care professionals were motivated more by convenience and ease, an external factor (Satz & Ferejohn, 1994). This may indicate educators are more aware of the human and environmental impacts, while veterinary care professionals are motivated by efficiency.

Both groups were aware of the connection between PPCPs to water and landfills which could further link their education expertise in this area. In addition, the motivation to avoid pet PPCPs in the water links back to the top environmental aspect value of having clean water/air for their pet. Another interesting point is that the legal motivation related more to the water motivations rather than abuse, which could be a higher desire to protect the environment from PPCPs. There was a lack in correlation between purchasing the minimum amount of PPCPs for their pet with doing what is financially affordable. This may indicate these respondents' desire to do what is best for the pet to ensure good health has a higher value than being limited economically.

Influencing activities

Similarly, influential activities on taking positive actions for protecting the environment were analyzed. Factor 1 "outreach" and factor 3 "economic" were mostly rational choice or institutional choice drivers. Factor 2 "social" were social proof drivers (Table 8). For the outreach factor, the most influential activity was to "learn about scientific studies on the consequences of a certain activity and positive actions I can take" followed by "encouragement from their professional organization" (Table 9). This shows that through trusted knowledge and professional networks, there can be room for influencing behavior change. When analyzing social drivers, we must keep in mind changing behavior through social groups and networks can have a great influence on taking action (Rowson, 2013). In the social factor, "people they know encouraging them to take action was the top activity", which reveals that again, social networks are trusted sources of reliable information that can influence respondents to take positive action for

the environment. When assessing the different professionals, the statistically significant difference between veterinary care professionals and educators was in the economic factor (Table 10). Veterinary care professionals were influenced more by economic factors such as reward and penalties than educators. The effect size for the economic factors was between "small" or "minimal" to "medium" or "typical" (Cohen, 1988; Vaske, 2008). It is easier for people to make institutional choices because there are few choices to select from and thus quickly can become habits (Anderson, 2013a). This could signify the institutional choice veterinary care professionals have due to policies and regulations they must follow as a part of medical protocol. In addition, both veterinary care professionals and educators were equally influenced by the social factors. These respondents rely on their trusted networks and colleagues when there are moments of uncertainty when dealing with unused pet PPCPs.

Environmental awareness

Respondents tended to be very aware of the environment and the impacts of PPCPs to the water and human health and most were informed on the environmental issues in their state (Figures 19, 20). This also links back to the environmental aspect they value for their pet: clean water and air. These respondents report they can make a difference for the environment based on the actions they take. This is supported by the majority of respondents (85%) who disagreed with the statement "If others don't take steps to live an environmentally friendly life then my actions won't matter". This shows that this "low hanging fruit" group of educated professionals is generally aware of the environmental issues surrounding PPCPs and that their actions can create change,

providing a high level of self-efficacy (Prinbeck, Lach, & Chan, 2011). Again, this could be due to their profession (e.g. science teachers with a focus on current environmental issues), but also how they acquire information on environmental issues.

It is interesting to point out that educators tended to be slightly more aware on “feeling a personal obligation to take action”, “pet waste is a source of pollution”, and “I take positive steps to live an environmentally friendly life” (Table 13). The background of these educators could have had an impact on how well aware they are of the environment. There was also a strong correlation between where they first look for information and where they prefer to learn more information (provider, internet, product label). This indicates respondents are looking for information from where they actually want to be getting information from, a trusted source. It is interesting to note that although these survey participants tended to be very aware of how their actions can impact the environment, only about 48% state they are only “somewhat informed” of environmental issues in their state and educators were slightly more informed than veterinary care professionals.

Needs and Sources of Information

When the needs were assessed, more environmentally friendly but effective alternatives were desired by the respondents (Figure 21). A need for more options that work and are effective can prove to be useful to pass on product success stories to others. This is where the focus on prevention and reducing waste can come into play with green chemistry and environmentally friendly products. When compared to what respondents are doing with their human pharmaceuticals (Table 1), the third top choice was to

disposal via a collection event, but when asked about the needs, this same option was the second top need. Many states, such as Oregon, has drop off collection boxes at many law enforcement offices in addition to take back collection events, so better publicity of these avenues should be a priority or additional collection boxes should be implemented.

Veterinary Professional Communication with Clients

For the veterinary care professional specific questions on discussing pet PPCPs disposal during appointments, it was surprising to see such a low percentage. After excluding those who stated they have not talked about PPCPs stewardship, veterinary care professionals who have the face to face time with pet owners do not discuss disposal of pet PPCPs due to reasons such as lack of knowledge and time. Even with the American Veterinary Medical Association (AVMA) signing a memorandum of understanding on outreach and education of veterinary clients on proper disposal of unused animal medications back in 2011, these results show that the information from these veterinary care professional networks have not successfully been passed on to those practicing in the field. From here, there can be further efforts in this area to develop a universal understanding of proper pet PPCPs disposal within the field.

Conclusion

With the increasing detections of PPCPs in the aquatic environment, it is important to target the sources of this emerging problem. The quantity and sources of PPCPs reaching the waterways will continue to increase unless proactive stewardship is carried out. Pet PPCPs are a new area of focus and with a rise in pet ownership in the past

few years, there is consequently an increase in pet PPCPs use and disposal. This study helped to document the status in use and disposal of pet PPCPs with specific set of respondents, as well as a concluding case that there is a connection between human and pet PPCPs use and disposal. With this similar action, efforts can be made to promote proper disposal of PPCPs as a whole, rather than specifically separating the two groups from each other. The disposal habits reported by these pet owners present opportunities for improving PPCPs stewardship programs and policies by looking for ways to focus on prevention and PPCPs reduction.

We observed using the HCAM as a framework for analyzing influences that rational choice, social proof, and institutional choice drivers are not mutually exclusive, often interact, and may be viewed differently by the professions in the study. To veterinary care professionals, some motivational drivers were seen as institutional choice, while to educators, those same motivational drivers were seen as social proof. Educators in this study were more motivated by environmental factors, while veterinary care professionals were motivated by economic factors. Also, the state where the respondents reside could also have an influence on their PPCPs actions depending on what disposal programs are available and if people are aware of them. Some states have more advanced programs and policies in place that allow for PPCPs stewardship actions. Although institutional choice may be the area for most successful behavior change, more research should be conducted to see how increasing social proof can a primary focus to drive behavior change beyond the current rational choice mode. From this study, professional networks indicate a strong sense of trust with new knowledge and information.

The needs specified from this group provide opportunity to focus on areas of PPCPs education and outreach programs. For veterinary care professionals, the lack of awareness of pet PPCPs disposal options hindered the information they could communicate to their pet-owning clients. There is a need to develop a universal understanding of proper pet PPCPs disposal within the professional field. Although Washington, Oregon, and Southern California have drop-off collection box locations, the results still show a need for drop-off collection boxes, which indicates these pet owners are either not aware these are available in their communities or would like to see more implemented. Also, the availability of environmentally friendly products can support these pet owners to take PPCPs stewardship action and ideally lead to reducing waste through green chemistry and product labeling. The needs and preferred information sources can help agency and organizations focus their outreach and education efforts to be more cost-effective by focusing on the priority areas. Overall, these educators and veterinary care professionals are aware of environmental impacts of PPCPs and how just simple actions they take can make a difference, even if people around them are not following suit. They can be role models for others to promote PPCPs stewardship.

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Figures

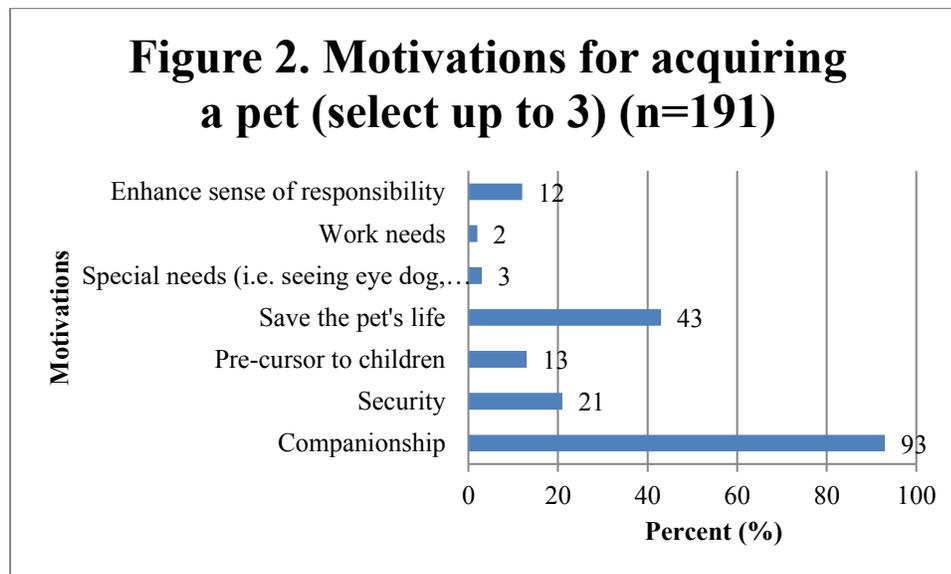
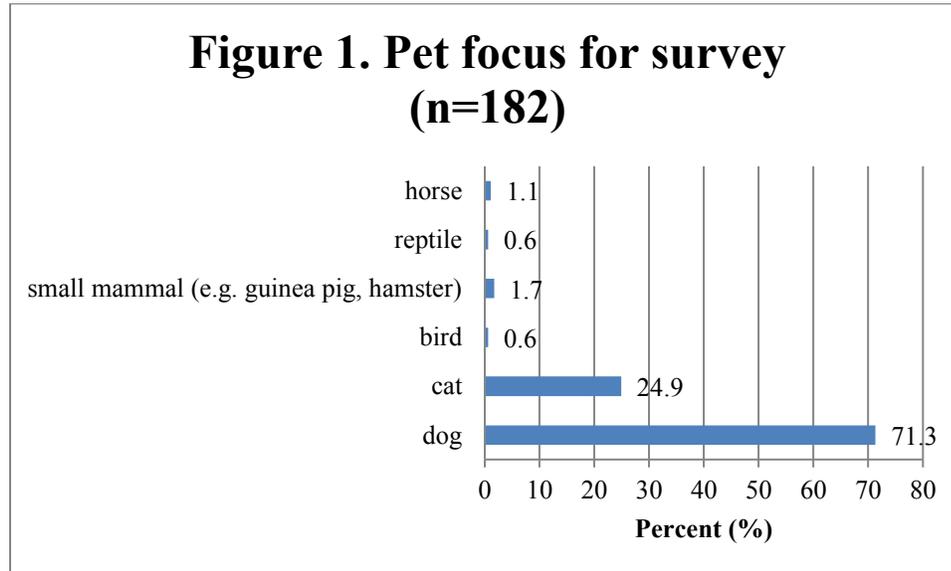


Figure 3. Concerns for pet's well-being (select up to 3) (n=191)

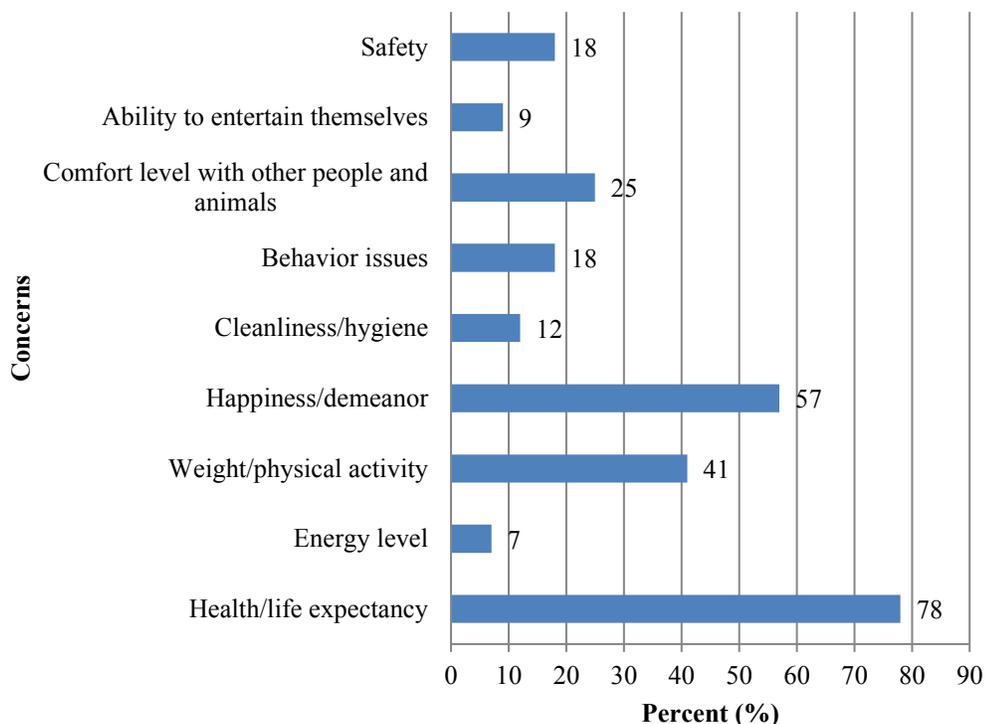


Figure 4. Environments where you prefer your pet to recreate (select up to 3) (n=191)

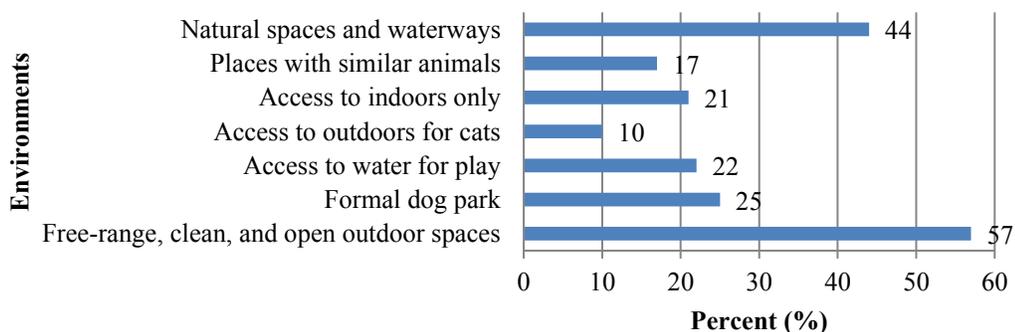


Figure 5. Aspects of environments that make them healthy for your pets (select up to 3) (n=191)

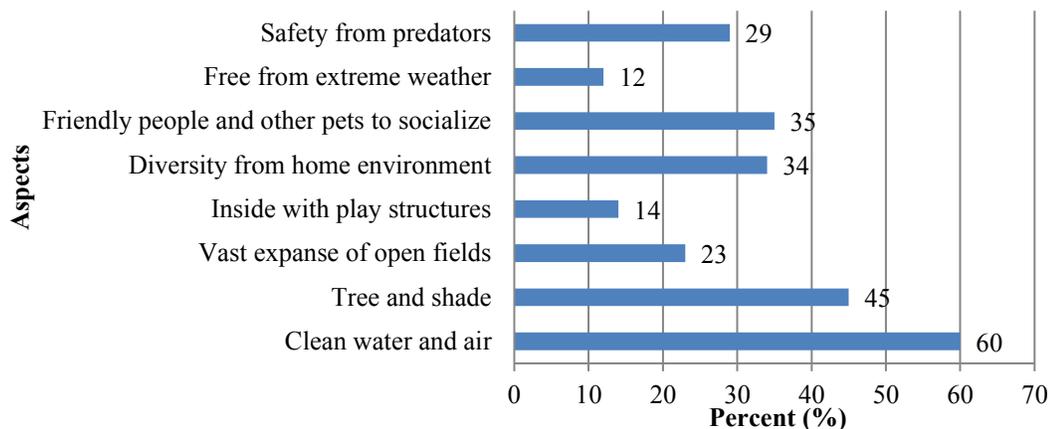


Figure 6. Purposely bought or considered buying pet personal care products that are designed to be environmentally friendly (n=166)

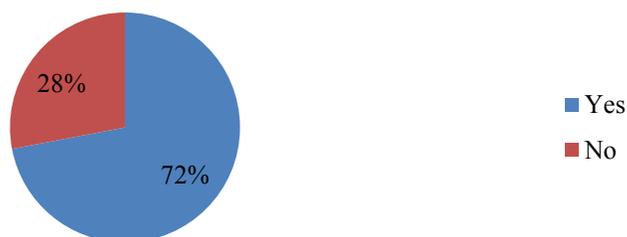


Figure 7. Reason for not purposely buying or considering buying environmentally friendly pet personal care products (n=47)

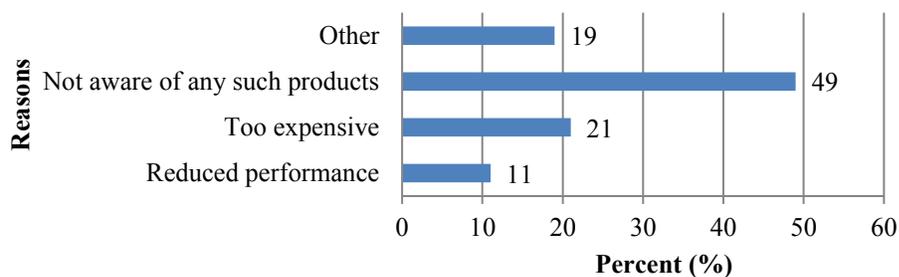
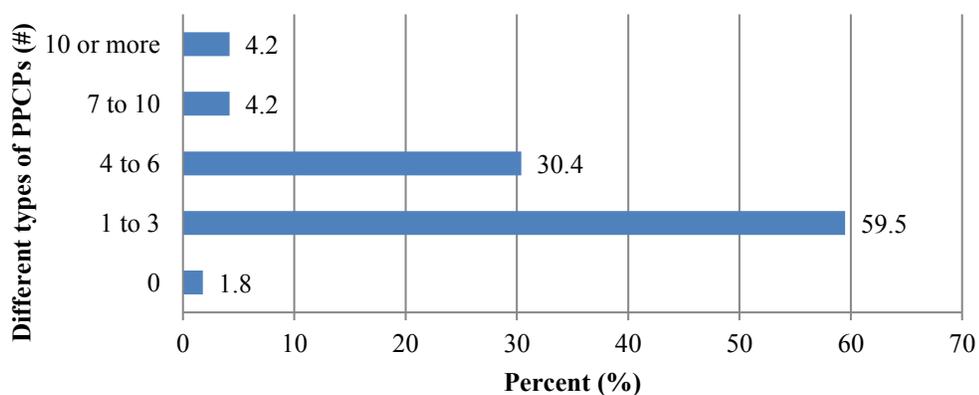


Figure 8. Number of different types/brands of PPCPs available to use on pet (n=168)



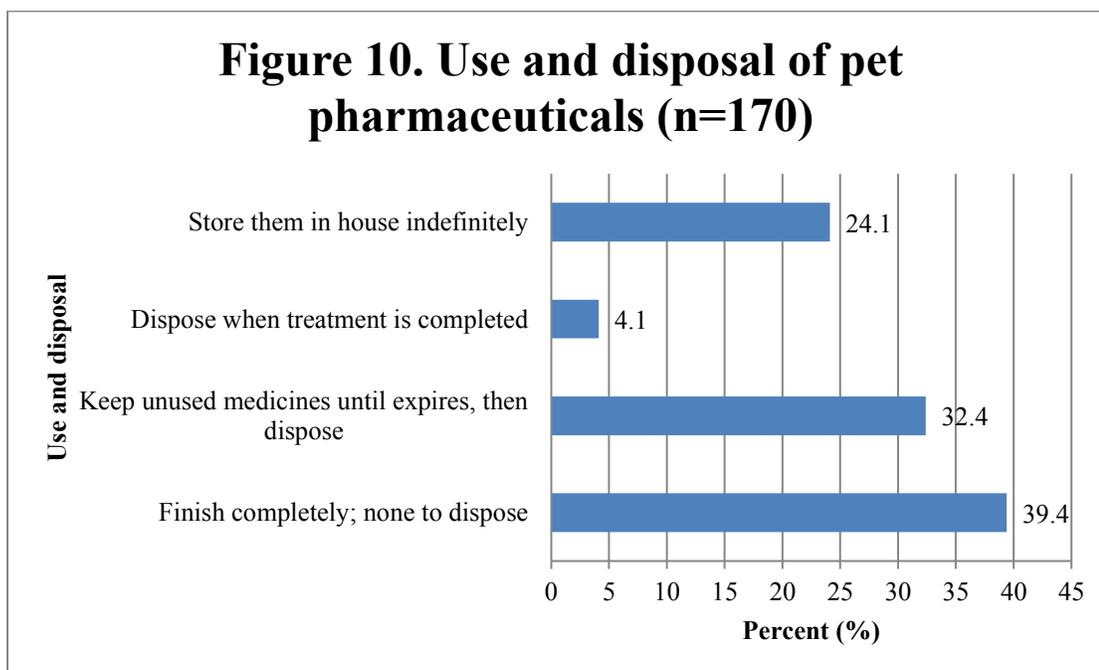
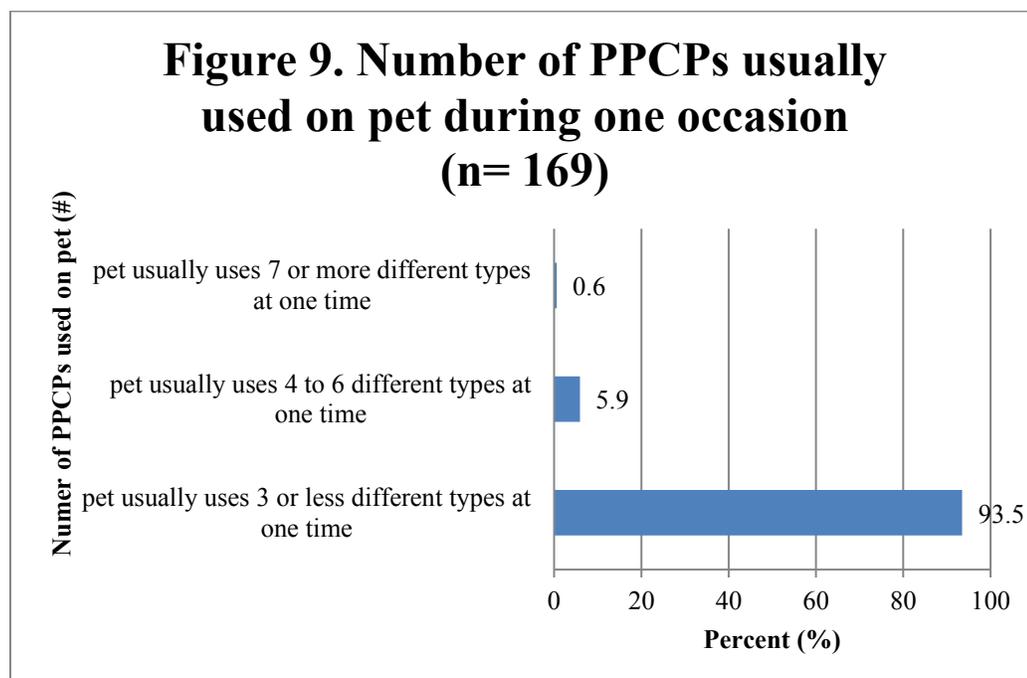


Figure 10a. Use and disposal of pet pharmaceuticals by profession (n=170)

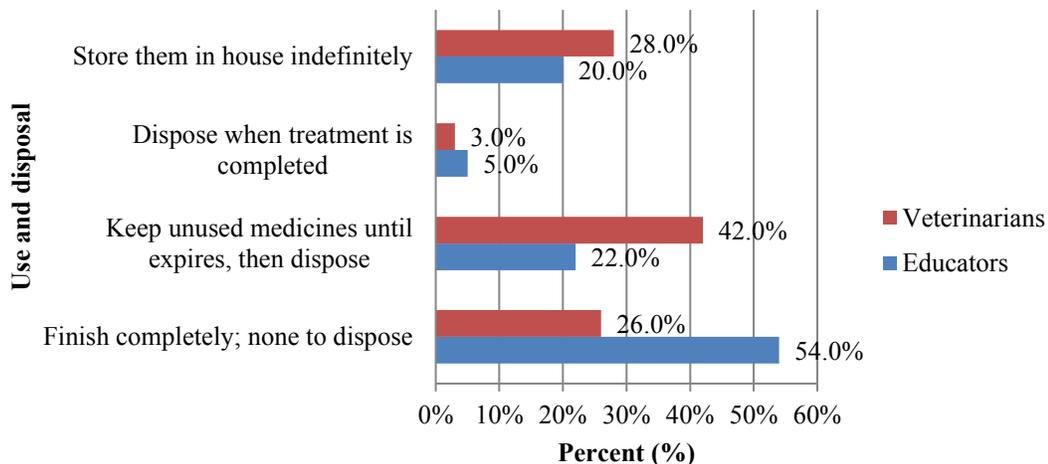


Figure 11. Proportion of unused pet pharmaceuticals in household (n=170)

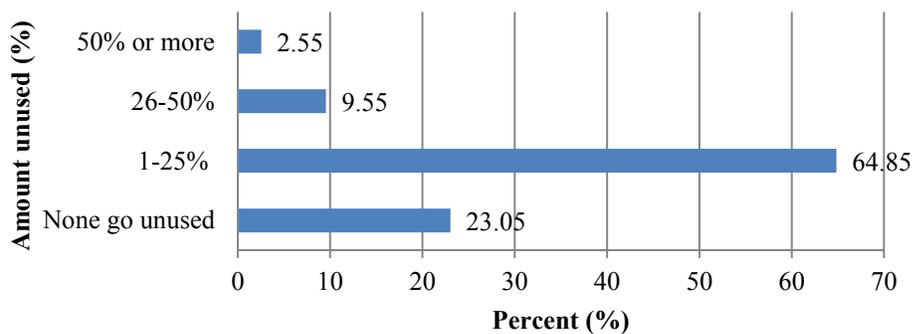


Figure 11a. Proportion of unused pet pharmaceuticals in household by state (n=170)

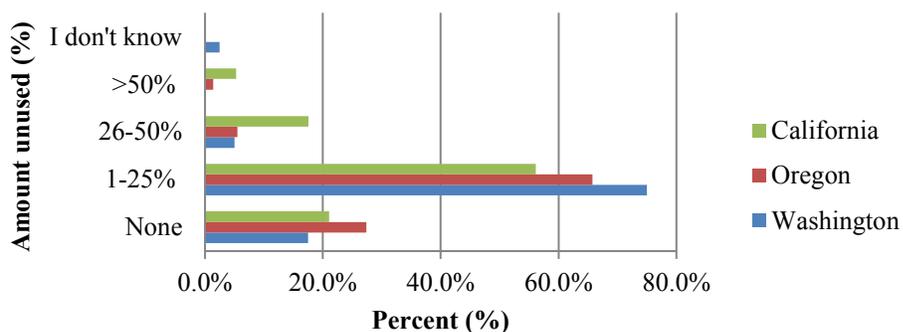


Figure 11b. Proportion of unused pet pharmaceuticals in household by profession (n=170)

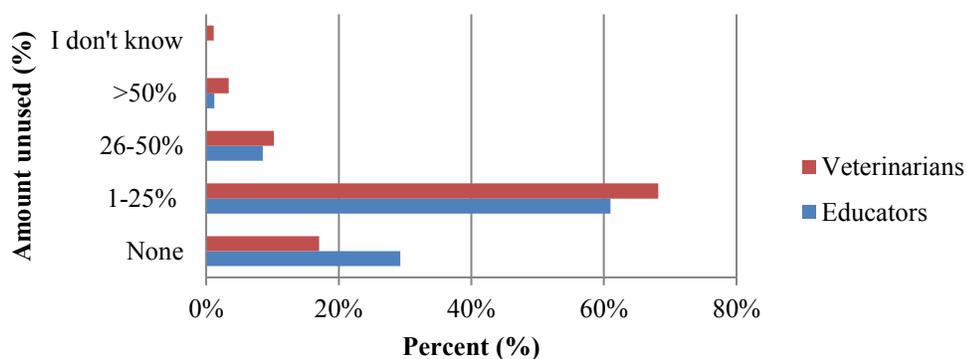


Figure 12. Use and disposal of pet personal care products (n=169)

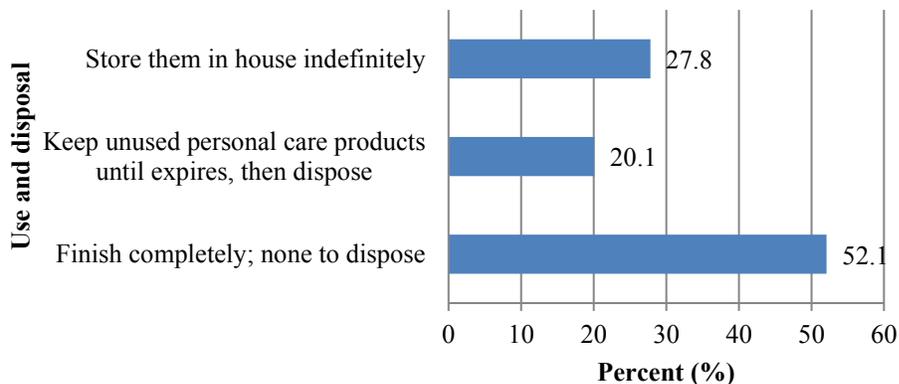


Figure 12a. Use and disposal of pet personal care products by profession (n=169)

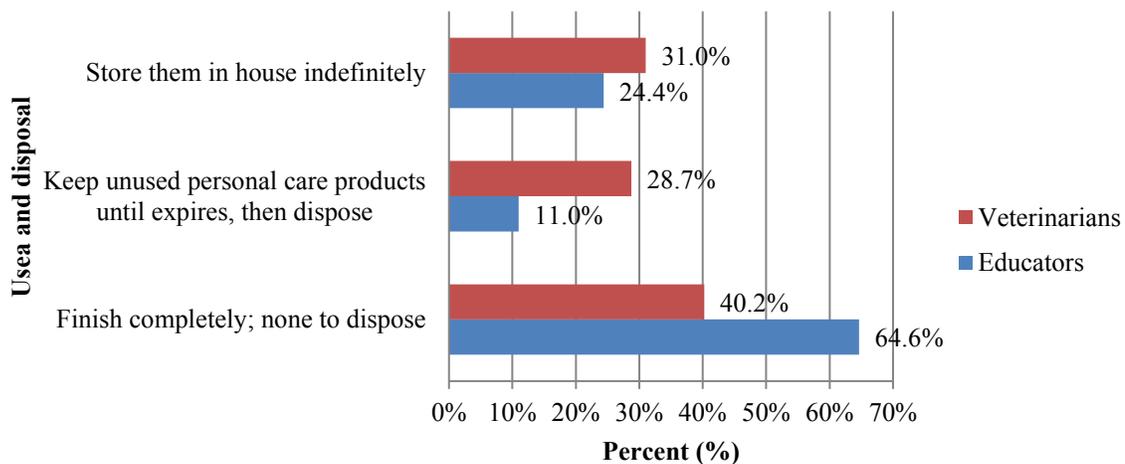


Figure 13. Proportion of unused pet personal care products in household (n=170)

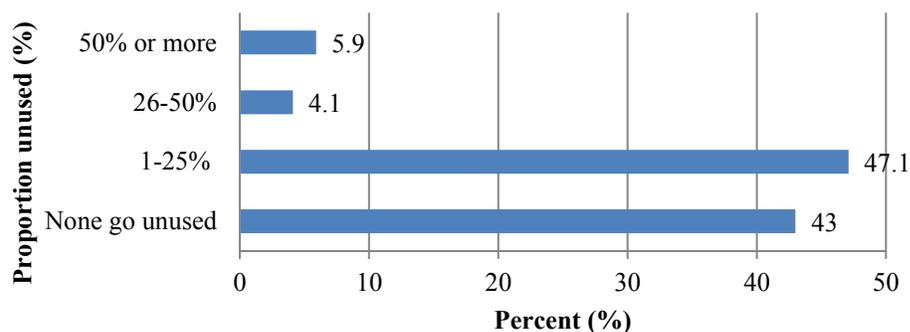


Figure 14. Decisions regarding purchase, use, and disposal of pet PPCPs extending to human PPCPs (n=176)

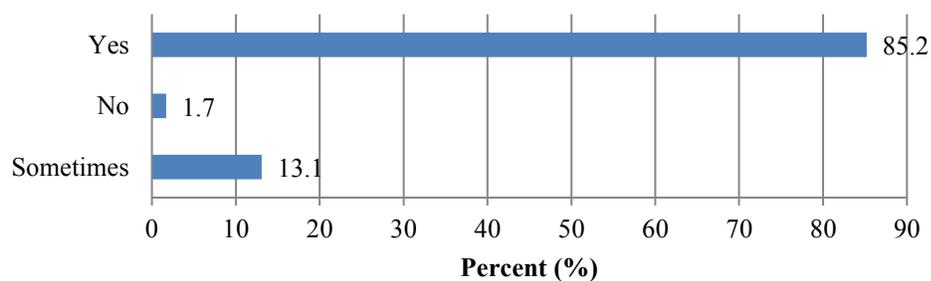


Figure 15. Human pharmaceutical disposal method by state (n=183)

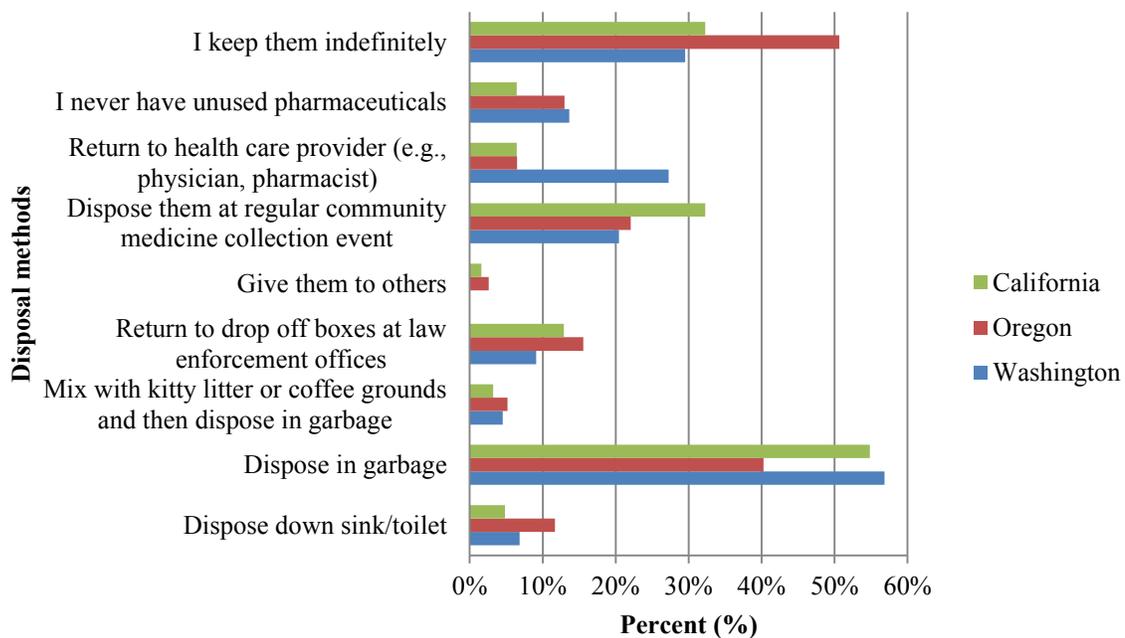


Figure 16. Human personal care products disposal methods by state (n=183)

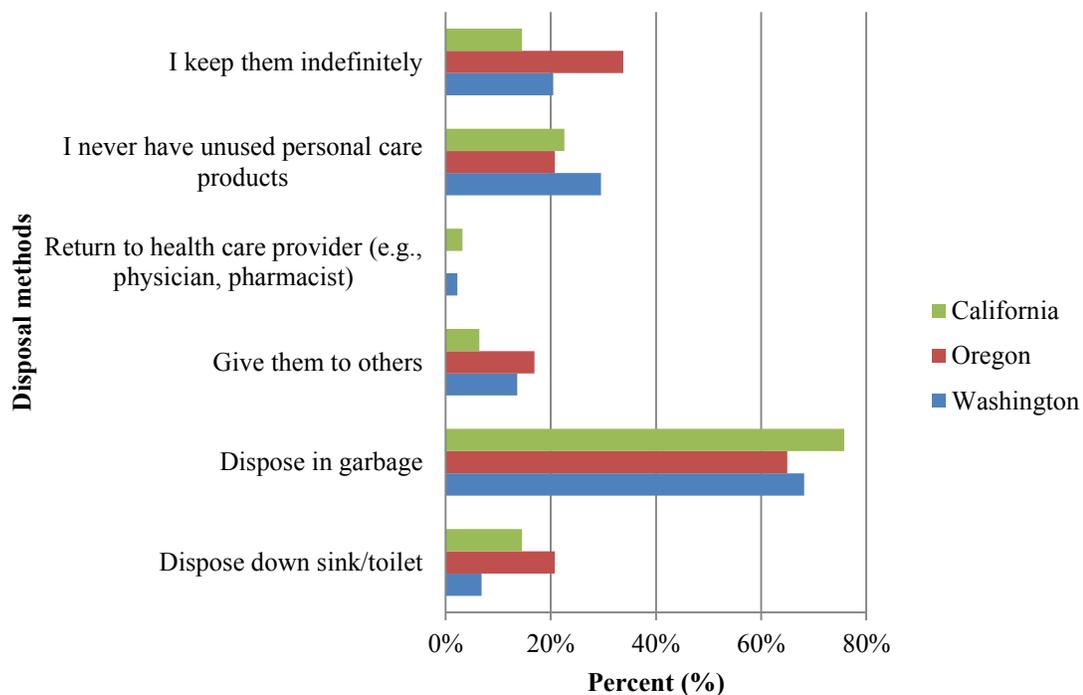


Figure 17. Pet pharmaceutical disposal method by state (n=183)

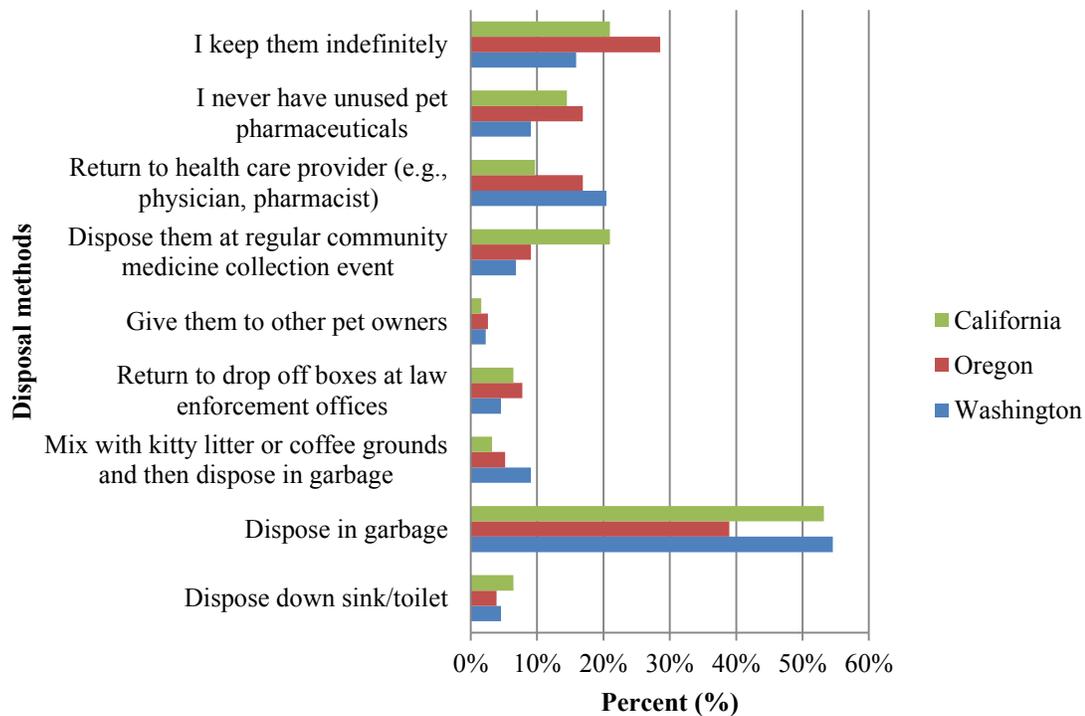


Figure 18. Pet personal care products disposal methods by state (n=183)

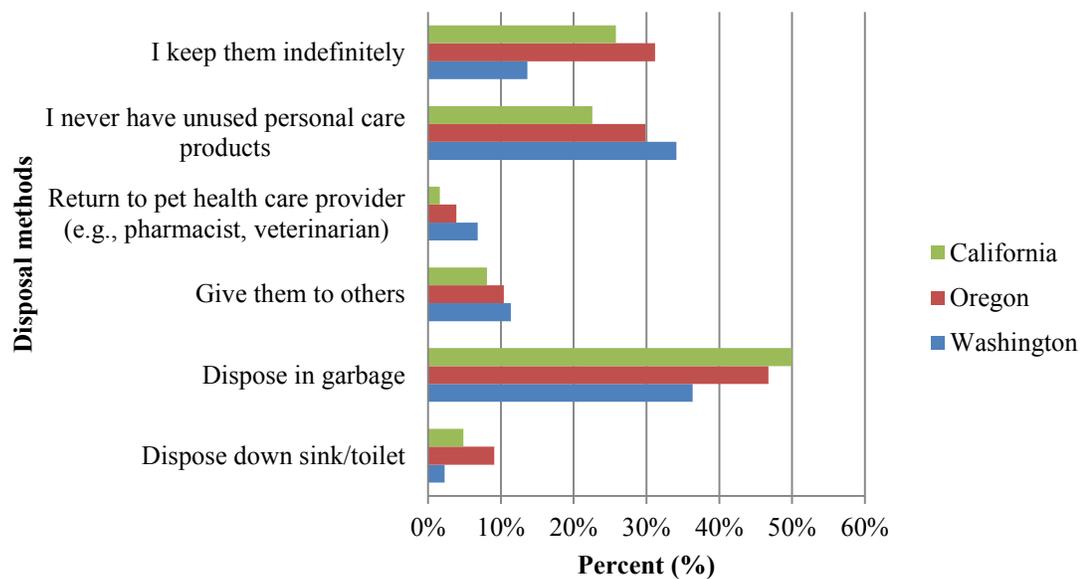


Figure 19. Environmental Awareness Statements (n=176)

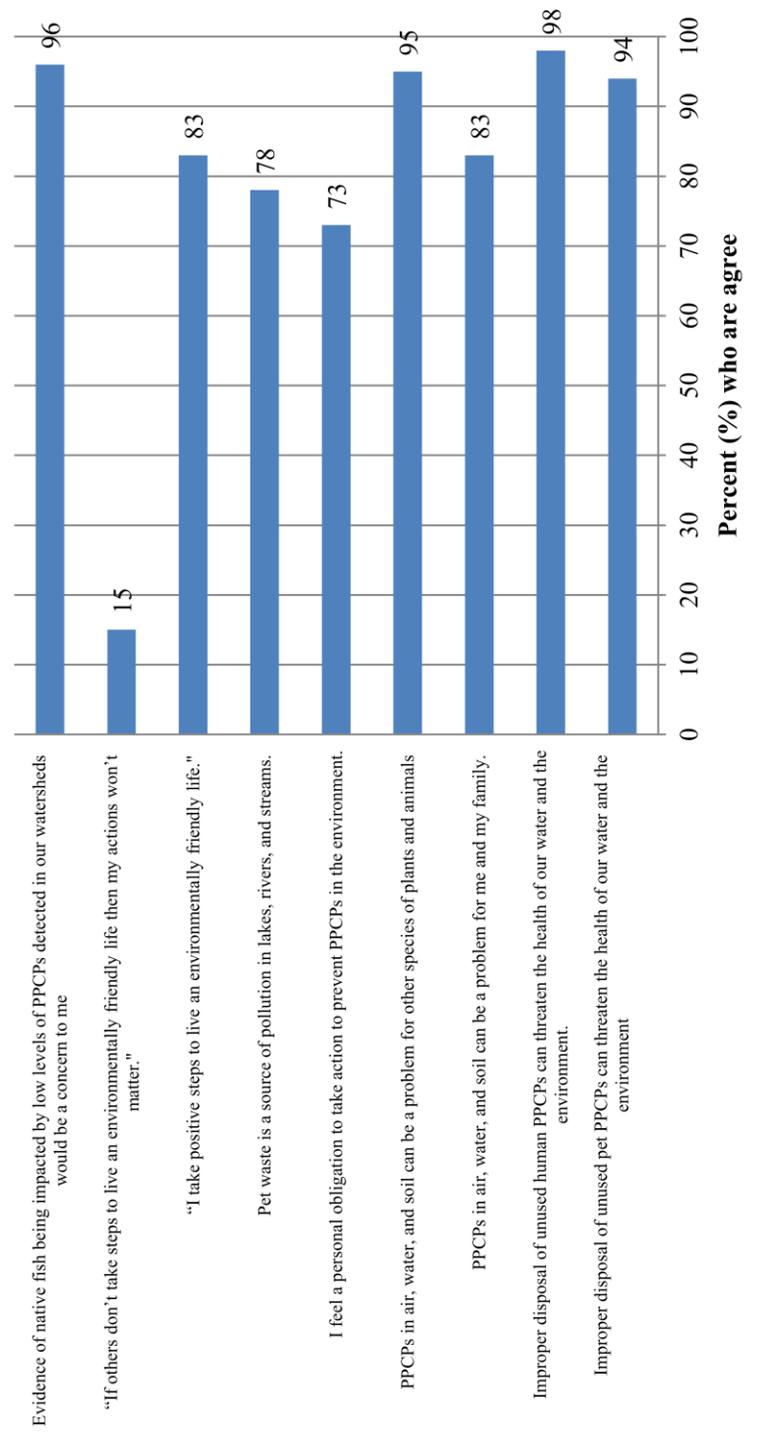


Figure 20. Informed about environmental issues in your state (n=104)

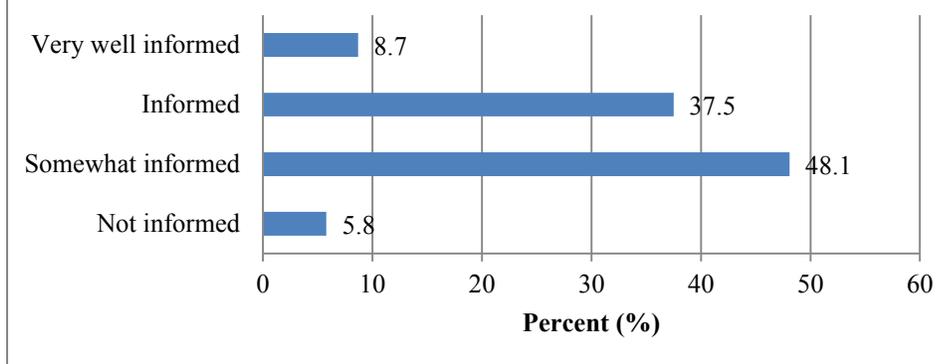


Figure 21. Needs to choose, use, and dispose of PPCPs in a more environmentally responsible way (select up to 3) (n=191)

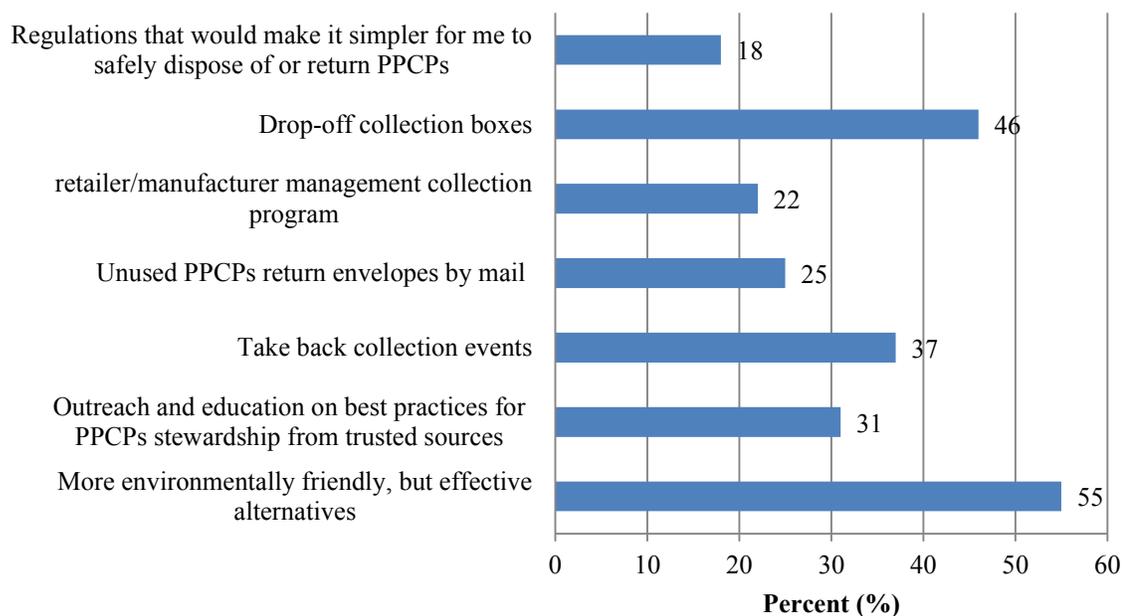


Figure 22. First 3 places to look for information on pet PPCPs disposal (n=191)

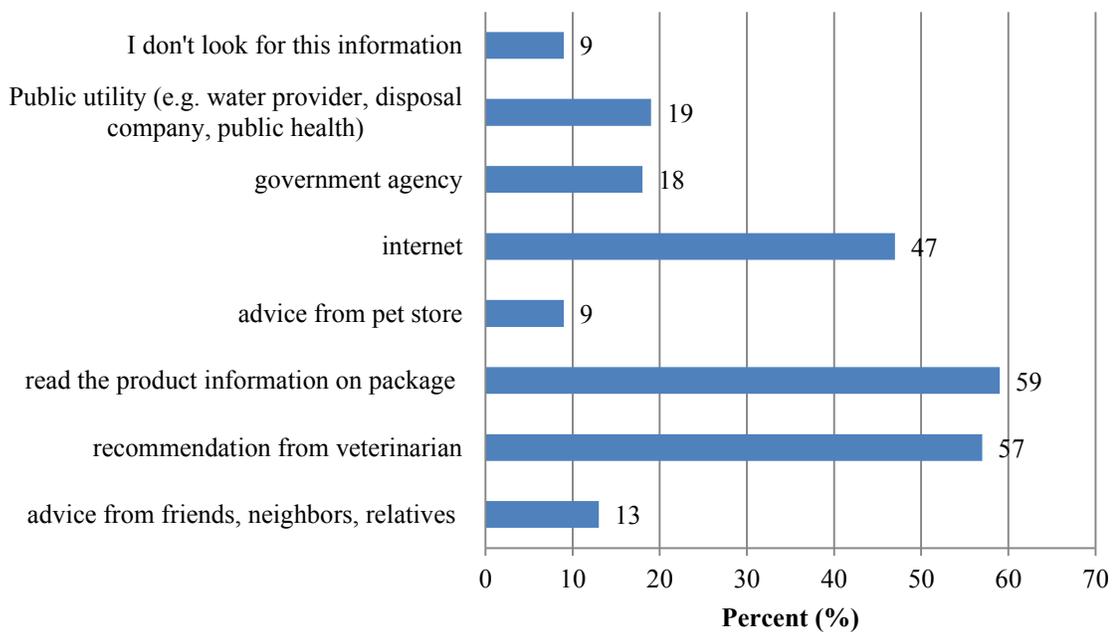
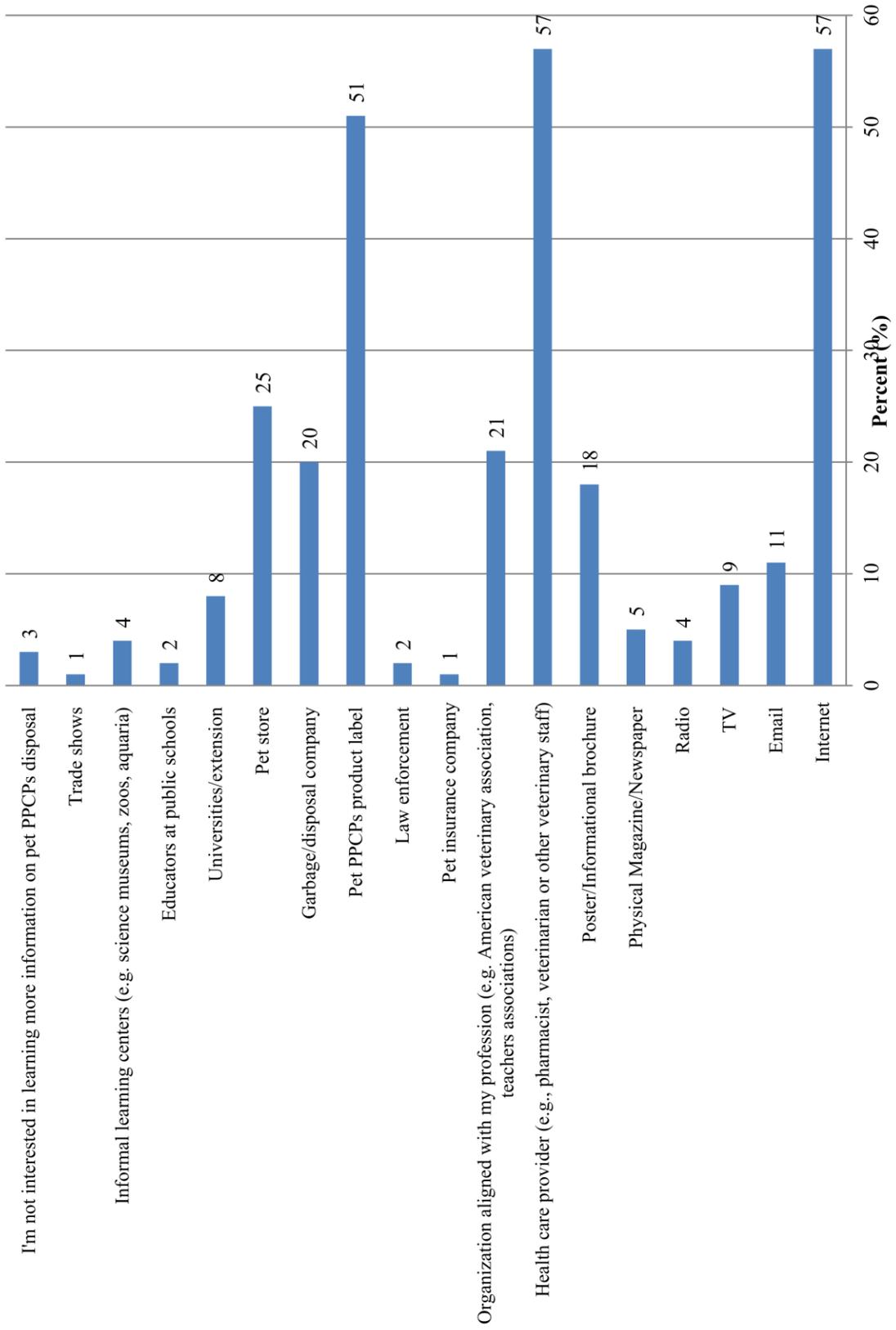
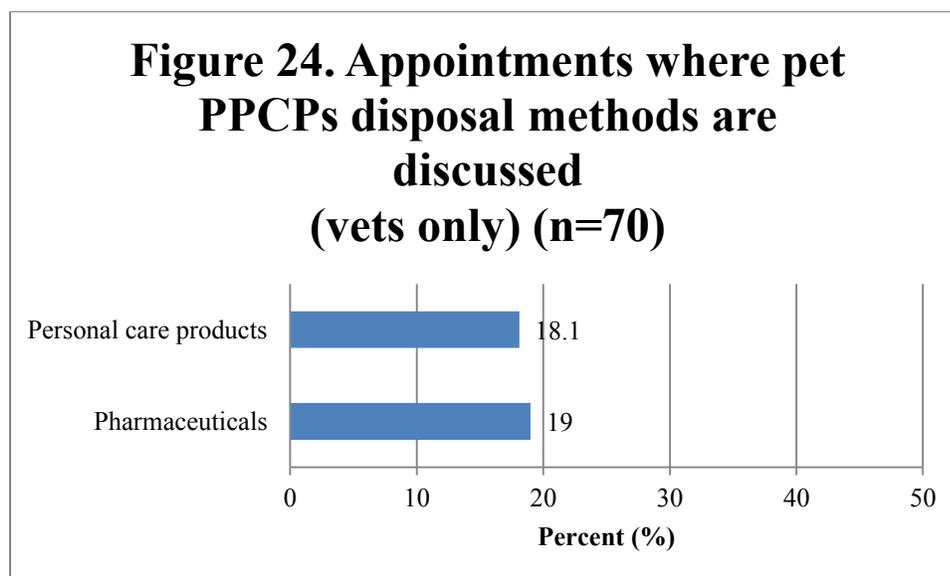


Figure 23. Prefer to learn more information from sources (select up to 5) (n=191)





Tables

Table 1. Pharmaceutical disposal methods (human vs. pet)¹

Disposal options	Human		Pet	
	N	Percent	N	Percent
Sink/toilet	15	8	9	5
Garbage	90	47	87	46
Mix with kitty litter or coffee grounds and then dispose in garbage	8	4	10	5
Return to drop off boxes at law enforcement offices	24	13	12	6
Give them to others	3	2	4	2
Regular community medicine event	46	24	23	12
Return to health care provider (e.g., physician, pharmacist)	21	11	28	15
Never have unused pharmaceuticals	20	11	26	14
Keep them indefinitely	72	38	42	22

¹Respondents were allowed to choose up to three disposal methods they practiced

Table 2. Personal care product disposal methods (human vs. pet)¹

Disposal options	Human		Pet	
	N	Percent	N	Percent
Sink/toilet	28	15	11	6
Garbage	127	67	83	44
Give them to others	23	12	18	9
Return to health care provider (e.g., physician, pharmacist)	3	2	7	4
Never have unused personal care products	43	23	52	27
Keep them indefinitely	44	23	46	24

¹Respondents were allowed to choose up to three disposal methods they practiced

Table 3. Disposal methods of pharmaceuticals based on user groups³

Disposal methods	Groups		χ^2 value ²	<i>p</i> -value	Effect size (phi Φ)
	Human	Pet			
Sink/toilet	8	5	5.21	.022	.21
Garbage	47	46	42.55	<.001	.46
Mix with kitty litter or coffee grounds and then dispose in garbage	4	5	8.46	.004	.30
Return to drop off boxes at law enforcement offices	13	6	44.31	<.001	.62
Give them to others	2	2	.13	.721	.02
Regular community medicine event	24	12	48.29	<.001	.54
Return to health care provider (e.g., physician, pharmacist)	11	15	15.28	<.001	.33
Never have unused pharmaceuticals	11	14	9.98	.002	.26
Keep them indefinitely	38	22	22.06	<.001	.34

Cell entries are percentages (%) who checked the disposal option; respondents were able to choose up to 3 choices

²Cell entries are reported as likelihood ratio due to smaller sample size and looks at the relationship between the groups

³Total sample size is 191

Table 4. Disposal methods of personal care products based on user groups³

Disposal methods	Groups		χ^2 value ²	<i>p</i> -value	Effect size (phi Φ)
	Human	Pet			
Sink/toilet	15	6	20.73	<.001	.41
Garbage	67	44	46.21	<.001	.47
Give them to others	12	9	9.77	.002	.27
Return to health care provider (e.g., physician, pharmacist)	2	4	3.07	.080	.20
Never have unused personal care products	23	27	28.37	<.001	.40
Keep them indefinitely	23	24	15.91	<.001	.30

Cell entries are percentages (%) who checked the disposal option; respondents were able to choose up to 3 choices

²Cell entries are reported as likelihood ratio due to smaller sample size and looks at the relationship between the groups

³Total sample size is 191

Table 5. Exploratory factor analysis of motivations when pet PPCPs disposal is chosen

Motivation items	Factor loadings ¹	
	Factor 1: Environmental	Factor 2: Personal
Desire to avoid risk of accidental poisoning	.82	
Desire to avoid risk of misuse/abuse	.81	
Desire to minimize pet PPCPs in water	.80	
Desire to minimize pet PPCPs in landfills	.72	
Follow what's legally required	.71	
Purchase only minimum amount of PPCPs for what my pet might need	.57	
Do what's most acceptable to my family, friends		.76
Do what's financially affordable		.71
Go with the flow. Do what the majority regard as acceptable		.69
Convenience/ease of disposal		.62
Heard that it's better to flush pet PPCPs		.61
Eigenvalue	3.42	2.32
Percent (%) of total variance explained ²	31.09	21.09

¹Principle components factor analysis with Varimax rotation. Only factors with eigenvalues greater than 1 and items with factor loadings greater than .40 were retained in the final factor structure (Tabachnick and Fidell, 1996). Items coded on a 5-point scale of 1 = very unlikely to 5 = very likely.

²Total cumulative percent (%) variance explained = 52.18%.

Table 6. Reliability analysis of motivations when pet PPCPs disposal is chosen

	Mean ¹	Item Total Correlation	Alpha If Item Deleted	Cronbach Alpha
Factor 1: Environmental				.83
Desire to avoid risk of accidental poisoning	4.33	.70	.78	
Desire to avoid risk of misuse/abuse	4.10	.69	.78	
Desire to minimize pet PPCPs in water	4.41	.70	.79	
Desire to minimize pet PPCPs in landfills	3.95	.57	.81	
Follow what's legally required	4.15	.55	.81	
Purchase only minimum amount of PPCPs for what my pet might need	4.03	.44	.84	
Factor 2: Personal				.70
Do what's most acceptable to my family, friends	2.35	.55	.62	
Do what's financially affordable	3.26	.48	.65	
Go with the flow. Do what the majority regard as acceptable	2.22	.49	.64	
Convenience/ease of disposal	4.10	.41	.67	
Heard that it's better to flush pet PPCPs	2.20	.39	.69	

¹Means are averages based on a 5-point scale where 1 = "very unlikely" and 5 = "very likely".

Table 7. Differences in motivations when pet PPCPs disposal is chosen based on profession

	Profession ¹		<i>t</i> -value	<i>p</i> -value	Effect size (<i>r</i> _{pb})
	Educator	Veterinarian			
Influences based on profession					
Factor 1: Environmental	4.32	4.00	3.00	.003	.22
Factor 2: Personal	2.79	2.91	1.03	.306	.08

¹Cell entries are means based on a 5-point scale where 1 = "very unlikely" and 5 = "very likely".

Table 8. Exploratory factor analysis of influencing activities to take positive actions for protecting the environment

Influencing activity items	Factor loadings ¹		
	Factor 1: Outreach	Factor 2: Social	Factor 3: Economic
See ads or public notices encouraging me to take action	.81		
Government agencies encourage me to take action	.79		
See news media coverage encouraging me to take action	.79		
My professional organization encourages me to take action	.68		
Learn about scientific studies on the consequences of a certain activity and positive actions I can take	.46		
See people I know and trust taking action		.85	
People I know encourage me to take action		.85	
Hear people talking to others about the dangers of not taking action		.76	
Financial incentive/reward			.86
Financial penalty			.84
Eigenvalue	2.68	2.29	1.56
Percent (%) of total variance explained ²	26.84	22.91	15.60

¹Principle components factor analysis with Varimax rotation. Only factors with eigenvalues greater than 1 and items with factor loadings greater than .40 were retained in the final factor structure (Tabachnick and Fidell, 1996). Items coded on a 3-point scale of 1 = no influence to 3 = major influence.

²Total cumulative percent (%) variance explained = 65.35%.

Table 9. Reliability analysis of influencing activities to take positive actions for protecting the environment

	Mean ¹	Item Total Correlation	Alpha If Item Deleted	Cronbach Alpha
Factor 1: Outreach				.79
See ads or public notices encouraging me to take action	2.24	.71	.70	
Government agencies encourage me to take action	2.20	.67	.71	
See news media coverage encouraging me to take action	2.28	.71	.70	
My professional organization encourages me to take action	2.43	.46	.78	
Learn about scientific studies on the consequences of a certain activity and positive actions I can take	2.77	.29	.82	
Factor 2: Social				.81
See people I know and trust taking action	2.33	.68	.71	
People I know encourage me to take action	2.34	.73	.67	
Hear people talking to others about the dangers of not taking action	2.19	.57	.82	
Factor 3: Economic				.69
Financial incentive/reward	2.12	.53		
Financial penalty	2.35	.53		

¹Means are averages based on a 3-point scale of 1 = no influence to 3 = major influence.

Table 10. Differences in influencing activities to take positive actions for protecting the environment based on profession

	Profession ¹		<i>t</i> -value	<i>p</i> -value	Effect size (<i>r</i> _{pb})
	Educator	Veterinarian			
Influences based on profession					
Factor 1: outreach	2.40	2.37	.47	.639	.04
Factor 2: social	2.32	2.26	.72	.475	.05
Factor 3: economic	2.14	2.33	2.07	.040	.16

¹Cell entries are means based on a 3-point scale of 1 = no influence to 3 = major influence.

Table 11. Proportion of unused pet pharmaceuticals unused in households based on profession

Profession	N	Mean ¹	<i>p</i> -value = .065
Educators	82	1.82	
Veterinarians	87	2.00	

¹Means are averages based on a 5-point scale where 1 = "none", 2 = "1-25%", 3 = "26-50%", and 4 = ">50%".

p-value based on ANOVA statistical test on mean differences between professions

Table 12. Specific human and pet personal care product disposal method differences based on profession

Disposal method (human or pet)	Educators	Veterinarians	<i>p</i> -value
Dispose in garbage (human)	.61	.77	.023
Give them to others (human)	.19	.06	.008
Dispose in garbage (pet)	.31	.59	<.001
I never have unused personal care products (pet)	.38	.20	.009

¹Means are averages based on a 2-point scale where 0 = "did not select" and 1 = "selected".

p-value based on ANOVA statistical test on mean differences between professions

Table 13. Specific environmental awareness differences based on profession

Awareness statement	Educators	Veterinarians	<i>p</i> -value
I feel a personal obligation to take action to prevent PPCPs in the environment	2.86	2.54	<.001
Pet waste is a source of pollution in lakes, rivers, and streams	2.87	2.64	.002
I take positive steps to live an environmentally friendly life	2.94	2.72	<.001

¹Means are averages based on a 3-point scale where 1 = "disagree", 2 = "neutral", and 3 = "agree".
p-value based on ANOVA statistical test on mean differences between professions

CHAPTER 3: GENERAL CONCLUSIONS AND FUTURE DIRECTIONS

The goals of this study were to establish baseline information on pet PPCPs use and disposal, as well as understand the behavioral influences and motivations to taking PPCPs stewardship actions among pet-owning veterinary care professionals and educators. PPCPs stewardship action encompasses being responsible and protecting the environment when it comes to dealing with PPCPs. Unless actions are taken to change how people are using and disposing of PPCPs, the quantities of PPCPs in the environment will continue to increase. As a specific subset of PPCPs, pet PPCPs in the environment is growing concern, especially with over half of the households in the U.S. owning at least one pet.

The results are also intended to provide a baseline on pet PPCPs use and influences on stewardship behaviors to guide more effective PPCPs education and outreach. The analysis in this study resulted in a quantitative description of both pet and human PPCPs disposal methods, motivations on taking specific PPCPs disposal actions, activities that influence taking positive action for the environment, and PPCPs education and outreach needs (Chapter 2). Because lack of research based knowledge on what motivates people (in this case, two influential professions when it comes to pet ownership and the environments) to take stewardship actions with regard to PPCPs disposal, the results of this study provide an insight into understanding some drivers of pet owner behavior when dealing with unused pet and human PPCPs.

Pet ownership values in this study indicates that the environmental aspects these pet owners cherish for their pet (clean water and air) is directly related to their motivation to take PPCPs environmental stewardship (desire to reduce pet PPCPs in the water).

When looking at the differences based on profession, educators were more likely to be motivated by environmental factors versus veterinary care professionals, who were more likely to be motivated by economic factors. There is also a sense of trust with people they know who encourage them to take action as well as scientific studies that report PPCPs impacts and actions they can take.

Limitations

The limitations to this study include the specific target of respondents: veterinary care professionals and educators. Although they were seen as the “low-hanging fruit” due to their ease of contact for the study, the results show these groups have a high environmental awareness on the PPCPs issue. In order to see the full usability of HCAM, targeting a more general audience of pet owners might better assess these drivers. With an audience more representative of the general public, it may show how HCAM might work at a community level. Regardless, a comprehensive list of drivers to taking action on PPCPs stewardship would help reinforce this initial assessment of HCAM.

Another limitation to the analysis is the coding system that was implemented. Some of the motivations and influential activities could have been double coded (i.e. rational choice and social proof). However, the data was analyzed with the initial coding system that was created before the survey was conducted. There was also a drawback to having an opt-in survey before the general survey. Since the opt-in survey included all the demographic questions and then respondents were given a unique code to take the general survey, there was not a way to link the demographics back to the general survey

for further analysis. However, it did allow for descriptive statistics characterizing the general demographics of the respondents.

Lastly, we asked veterinary care professionals a set of extra specific questions pertaining to PPCPs disposal communication to pet owners in appointment settings. These questions could have been adapted for the educator audience as well, as they may also have interaction with pet owners.

Future Implications and Next Steps

The flexibility of HCAM framework is a useful characteristic for understanding triggers on people's capacity to take action; not only can it apply to the issue of taking action on PPCPs in the environment, but it may also work with other areas in which behavior change is a goal (i.e. increasing recycling, reducing carbon footprint). The model suggests the human capacity to act focuses on a few choices at a time; a plethora of information will not change behavior. The HCAM framework can be utilized to help visualize factors to behavior change and provide practical use for communicator and other professionals who use outreach and education to reach a general audience.

Veterinary care professional and educator networks may be able to use the HCAM framework to better understand what conditions might be more influential and adopt more effective education and outreach communication to their professional groups. Current programs that address PPCPs disposal, such as collection events, can also benefit from the study findings to improve their outreach to the general public and increase the number of people participating in the activities by including pet PPCPs in their programs. Monitoring and detection efforts can also apply HCAM to how science research findings

are disseminated to the public in an effective manner where the new and upcoming knowledge is easily understood as the results from this study show that there is trust placed on scientific studies and professional networks.

Current existing education and outreach programs only reach a small subset of the population because many people are not aware of these options. In order to directly address this issue, there needs to be more effort and research looking at how these programs can effectively reach a broader audience and support positive PPCPs stewardship actions and lead to an expansion on the current status of PPCPs.

By examining how and why pet owners acquire, use, and dispose of PPCPs, we begin to understand some of the drivers that influence decisions and potential outcomes to addressing this emerging contaminant issue. This can lead to improved communication with stakeholders that can result in more effective programs, studies, and policies on PPCPs stewardship. A need from this survey is more environmentally friendly PPCPs and this is where pollution prevention can come into play through green chemistry. In addition, this study provided insight into how programs can work with these specific stakeholders of professionals to improve PPCPs stewardship.

This study was initially envisioned with the greater goal of addressing how people make decisions when it comes to the use and disposal of PPCPs and in turn, help make education and outreach on this topic more effective to different stakeholders. Although the results of the this study are quite specific to the targeted audience of educators and veterinary care professionals on the West Coast, this research provides baseline information and a framework for future and broader studies as PPCPs in the environment will continue to be an issue for years to come.

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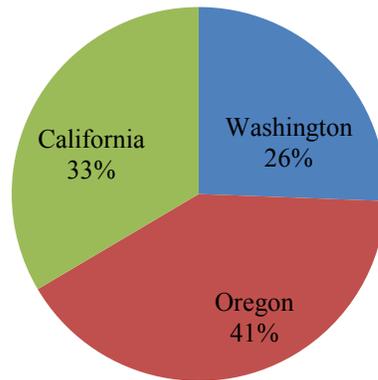
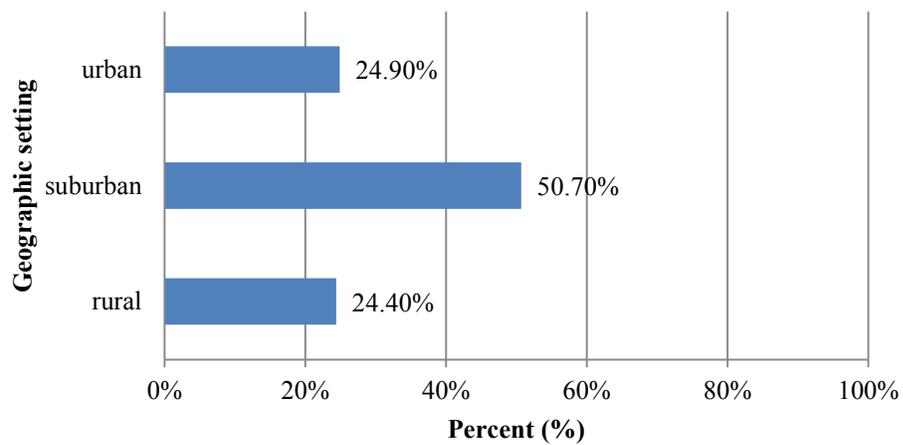
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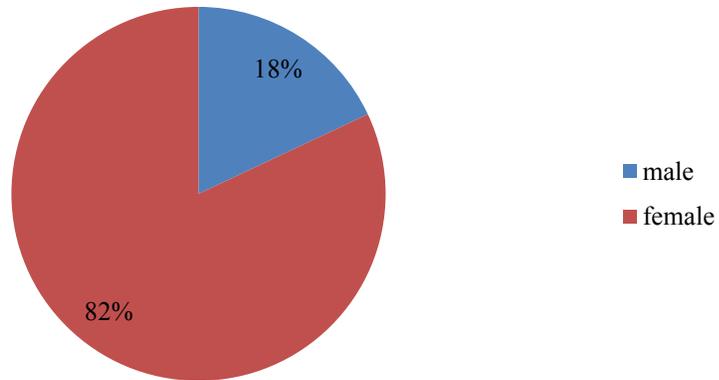
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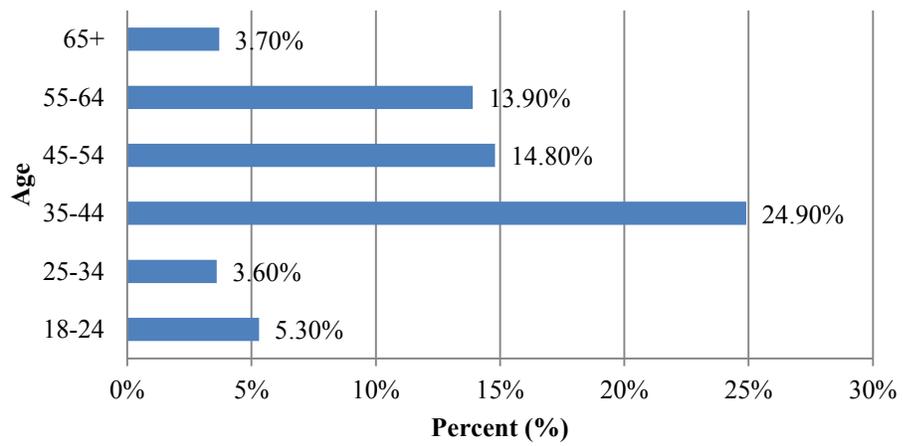
APPENDICES

Appendix A. Demographics of opt-in survey**A1. State of residence - All (n=203)****A2. Geographic setting - All (n=203)**

A3. Sex - All (189)



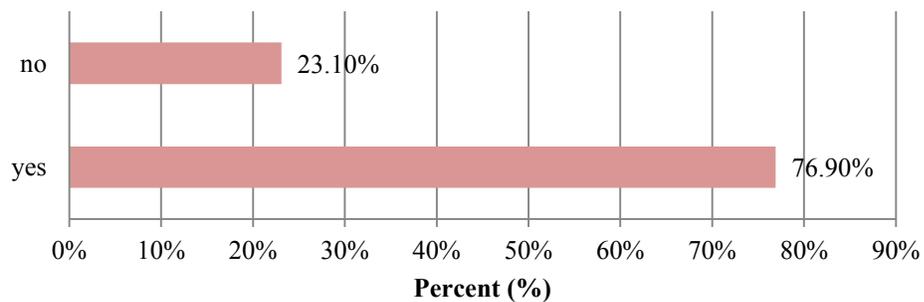
A4. Age - All (n=189)



A5. Practice in veterinary field -

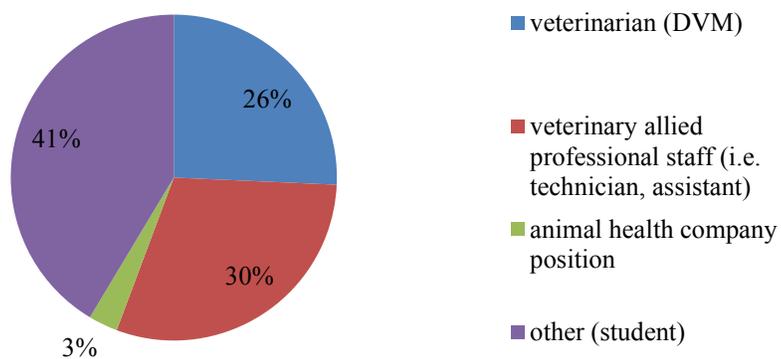
Vets (n=91)

**(e.g. practice medicine and see patients,
interact with clinicians)**

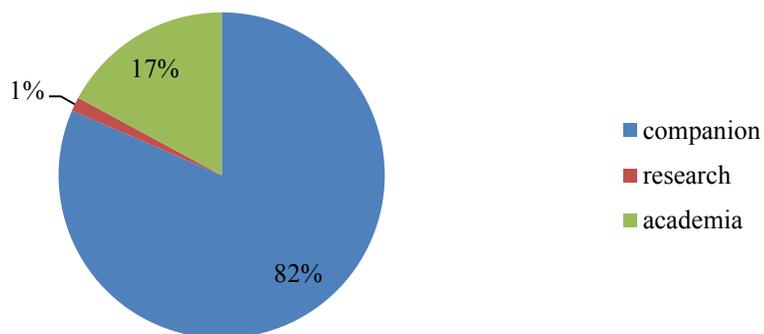


A6. Veterinary positions held - Vets

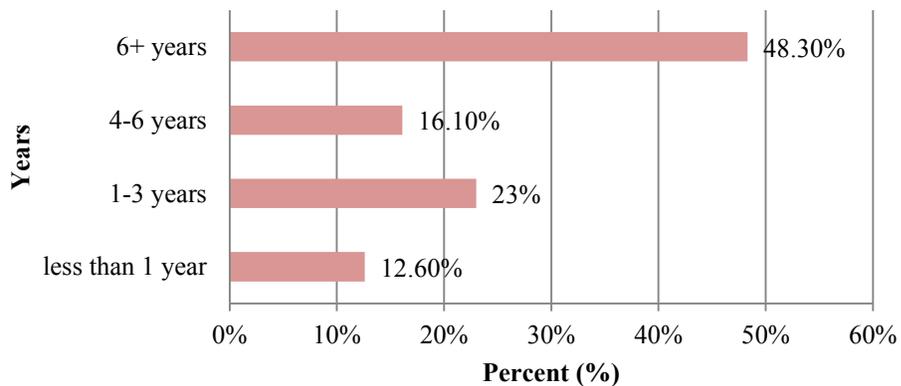
(n=70)



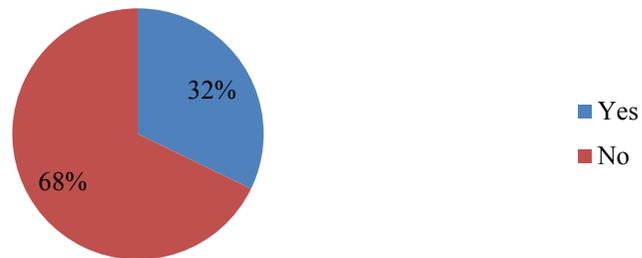
A7. Area of veterinary care - Vets (n=170)



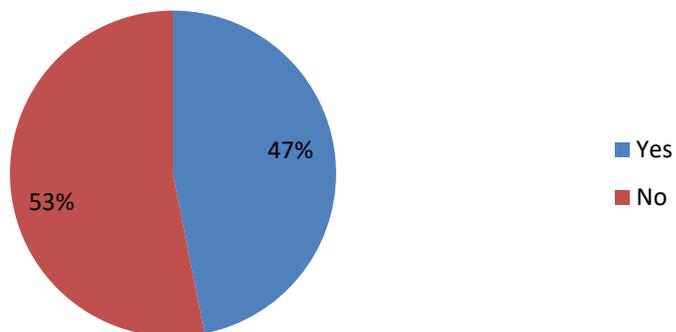
A8. Veterinary years of experience - Vets (n=87)

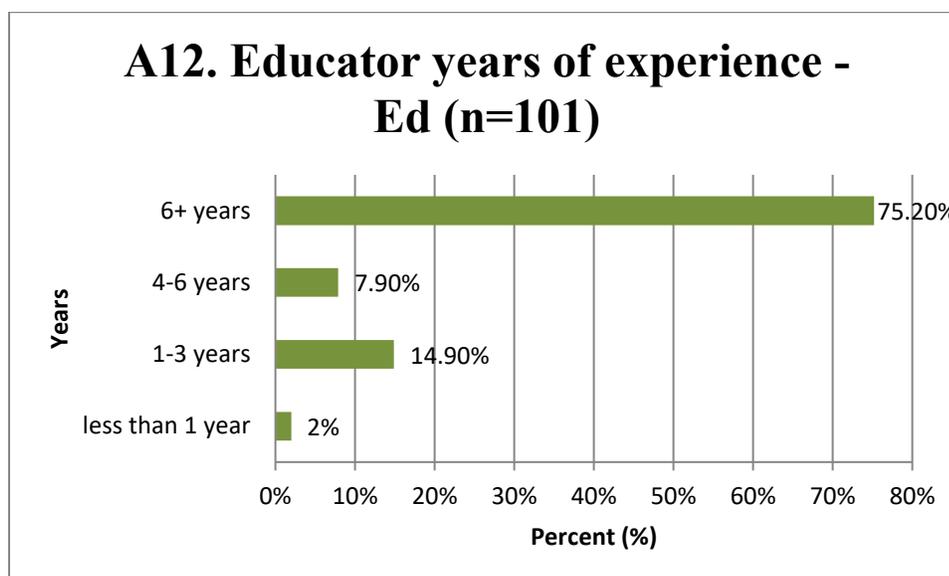
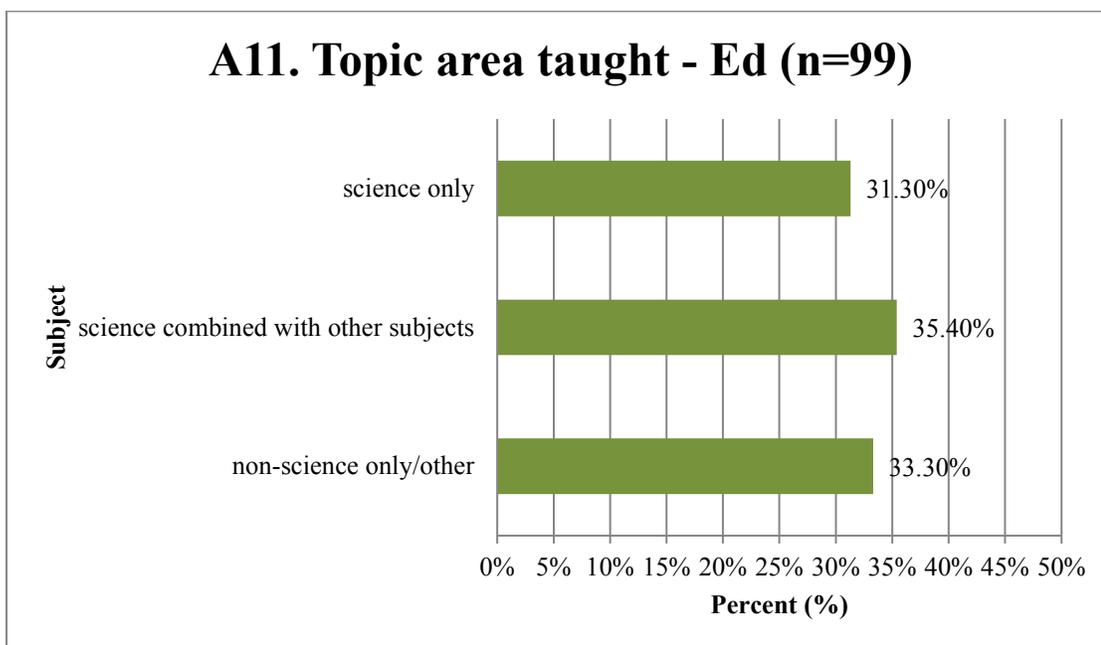


A9. Primarily teach in an informal setting - Ed (n=115)
(e.g. zoo, aquaria, science center, museum, park)

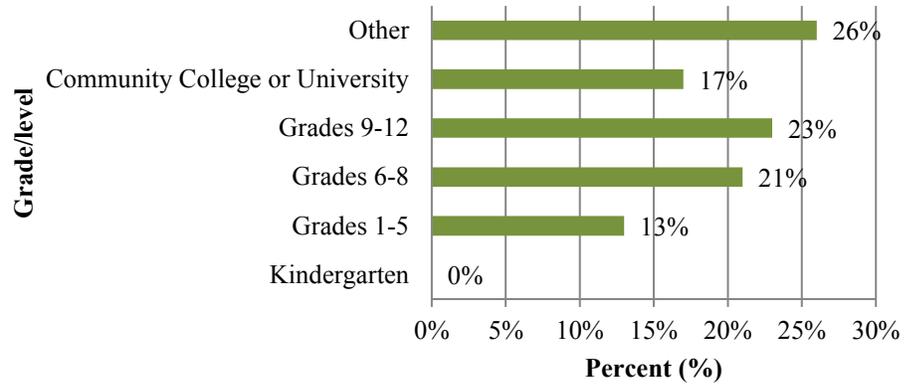


A10. Teach in a formal setting - Ed (n=113)





A13. Grade level currently teach - Ed (n=53)



Appendix B. Sample List of Recruitment Contacts

This appendix provides a sample list of key informant networks that were contacted in order to recruit participants for the survey.

Veterinary Care Professionals

Washington State Veterinary Medical Association
Washington State Association of Veterinary Technicians
Oregon Veterinary Medical Association
Southern California Veterinary Medical Association
WA, OR, CA Student Veterinary Clubs

Educators

Washington School Information Processing Cooperative
Environmental Education Association of Oregon
Watershed and Invasive Species Education
Oregon State University STEPs
OceanList
WA, OR, CA State Teacher Associations

Appendix C. Institutional Review Board Protocol

RESEARCH PROTOCOL

17 September 2013

1. Title: Understanding Pet Owner Knowledge and Behaviors Regarding Pet Pharmaceutical and Personal Care Products Use and Disposal into the Environment

PERSONNEL

- | | | |
|----|------------------------|-------------------------|
| 2. | Principal Investigator | Flaxen Conway |
| 3. | Student Researcher(s) | Jennifer Lam |
| 4. | Co-investigator(s) | Samuel Chan, Dave Stone |
| 5. | Study Staff | Danielle Goodrich |

6. Investigator Qualifications

Prof. Flaxen Conway is the director of the OSU Marine Resource Management program, a professor in the Sociology Department who conducts social science research on cooperative learning and research, and an Extension community outreach specialist for Oregon Sea Grant. Prof. Samuel Chan is watershed health and aquatic invasive species specialist in Sea Grant Extension and an Assistant Professor in Fisheries and Wildlife where he teaches classes on risk analysis. He is also the Broader Impacts Team Leader for the NSF Willamette Water 2100 project. Over the past 6 years, Prof. Chan has served as the PI and advisor to graduate students for projects of bi-national, national and region scope based on IRB approved surveys and focus groups. Prof. Dave Stone is the Director and Principle Investigator of the National Pesticide Information Center, Associate Professor of the Department of Environmental and Molecular Toxicology, as well as the Co-Leader of Superfund Research Program. His main responsibilities at OSU center around human health concerns related to chemical exposure, approaches to risk assessment and engaging diverse audiences in risk communication. Jennifer Lam is a Marine Resource Management graduate student and a watershed and invasive species education research technician with Oregon Sea Grant at OSU. She completed IRB training over 3 years ago as a student intern in the PROMISE program. Ms. Lam assisted in the design; implementation and analysis of surveys for IRB approved studies and the planning of IRB approved focus group studies, logistics, transcriptions and coding under PI and Co-PI guidance while employed with the Oregon Sea Grant College Program guidance. Ms. Lam has taken on increasingly important roles helping to research and develop survey topics and questions and authoring extension publications. Danielle Goodrich is an Oregon Sea Grant intern and has completed IRB training.

7. Training and Oversight

Jennifer Lam's graduate committee provides training and oversight. All graduate committee members (Drs. Chan, Conway and Stone) have successfully completed the online training and been conducting IRB approved human research for decades. Members of the committee will review research protocols and data as needed through personal and

electronic communications. PI and committee will discuss research and interview protocols and progress with student researcher, and will suggest changes as needed. Prof. Conway, Professor of Sociology, serves as the PI for this survey. Prof. Conway is responsible for all human subject protections issues and for the timely and complete submissions of IRB related documents. The PI is responsible for all training and oversight of the study and will review and submit all required documents to the IRB.

Training will consist of guiding and reviewing protocols ensure that personnel involved with data collection and analysis complete IRB CITI training on human subject's research. The PI and/or the committee will meet as needed with Ms. Lam to ensure adherence to protocol and determine if modifications are needed. Prof. Chan serves as the major advisor providing overall guidance on problem analysis, watershed implications and broader impacts. Professor Stone provides environmental toxicology and extension expertise.

Only the PI, co-investigators, the student researcher and personnel with IRB training certification will collect and analyze data on the project. All have conducted IRB approved studies. As such, we are all familiar with the importance of protocol adherence, consent and confidentiality, as well as tracking data collection to prevent over enrollment. No extended PI absences are expected.

FUNDING

8. Sources of Support for this project (unfunded, pending, or awarded): Support for the student researcher in this proposal comes from a variety of watershed health related grants led by the major advisor through NOAA, USFWS, NSF and Sea Grant Extension faculty incentive funds.

DESCRIPTION OF RESEARCH

9. Description of Research

This research is intended for thesis material as partial requirement of a M.S. degree. The overall goal of the project is to understand the drivers of human behavior regarding the acquisition and eventual disposition of unwanted pet (and ultimately personal) pharmaceutical and personal care products (PPCP) to guide the development of more effective programs that can decrease the amount of PPCP going into waterways. Although there is a growing body of monitoring and research on the water quality and ecotoxicology effects of PPCP in the water, there is a paucity of research on the human dimensions to guide and evaluate PPCP stewardship. We propose an approach to begin filling in this gap on the human dimensions and to improve our understanding of pet PPCP and pet owner attitudes, norms, knowledge, and the "triggers" leading to behaviors on use, flow, and disposal of PPCP through the exploration of the roles of "social proof" and "rational choice" theories in guiding use and disposal actions.

This research looks at how pet owners (typically a significant and highly engaged segment of society) use and dispose of pet PPCP (and ultimately their personal PPCP) and their knowledge on impacts of PPCP and consequences of improper disposal on the

aquatic environment. Ultimately, we seek to: 1) understand pet owner attitudes, norms, knowledge, and triggers of behaviors on use, flow, and disposal of pet PPCP, 2) understand if there are relationships between pet owner use and disposal of pet and human PPCP, and 3) use research results to guide outreach and engagement to encourage effective PPCP stewardship and reduce impacts on the aquatic environment.

10. Background Justification

Increasing detections of multiple classes of PPCP in aquatic environments signal an emerging public health and environmental threat in North America and much of the developed and emerging world economies. It is estimated that 40-50% of all prescribed and over-the-counter medications purchased by consumers go unused (Teleosis, 2007).

Existing and new classes of pharmaceuticals are produced and prescribed in increasing volumes every year. Since the mid-1990's, an increasing number of studies (Morace, 2012 & Boxall, 2012) have documented low concentrations of pharmaceuticals accumulating in watersheds and their acute impacts to aquatic organisms. Yet there is little research on what motivates people to take PPCP steward actions.

For this project, our focus will be on pet owners. We will target two subgroups: educators who are pet owners and veterinary professionals who are pet owners. Humans have strong bonds with their pets. According to the AVMA, more than half of the households in the USA owned pets in the 2011 year end. 36.5% have least one dog; 30.4% have at least one cat. In Portland, OR, 34% of households have a dog, with an average of 1.6 dogs/dog-owning household (AVMA 2012).

11. Multi-center Study – N/A

12. External Research or Recruitment Site(s) - N/A.

13. Subject Population and Recruitment (see attached below for recruitment emails): The target number for this survey research study is no more than 8000 participants. We have one broad target audience for this research: pet owners. Within this group, there are two subgroups:

- Veterinarians and allied veterinary professionals: Dr. Tim Miller-Morgan, DVM and OSU faculty member will serve as a key informant and provide his Oregon Veterinary Medical Association list, Washington Veterinary Medical Association list, and Southern California Veterinary Medical Association list.

- Environmental Educators: Educator networks in the Oregon, Washington, and Southern California (such as the NW Aquatics and Marine Educators Association, Environmental Education Association of Oregon, and the Watershed and Invasive Species Education Network) will serve as key informants to reach the members of these education associations and networks.

After contacting key informants, the recruitment will occur through an opt-in survey (link) that is distributed to all email lists. Once participants opt in, they will be assigned a unique code for their anonymous participation in the general survey.

14. Consent Process: (see attached below for online consent form) Consent will be obtained from all survey participants with an electronic consent form as the first question of both surveys. This will include a description of all participant requirements and will also serve as an agreement to participate. When the respondent clicks that they “agree” with an informed consent statement they will be allowed to enter their code and proceed with the survey.

15. Eligibility Screening: Potential participants in this study include pet owners that are either educators or veterinary professionals who are 18 years of age or older.

16. Methods and Procedures: (see separate document for surveys)
We will target up to 8000 pet owners in this research. We will use OSU Qualtrics survey system to conduct this research.

Key informants (as described earlier) already have a list of members from each network and will distribute the recruitment script and a link to the opt-in survey to their entire membership. Those who opt-in will be sent a unique identification number that ensures confidentiality and a link to the survey. Participants who indicate that they would like to participate via paper copy will be mailed a hard copy with a self-addressed and stamped envelope. All non-respondents will be contacted via standard survey protocol (Dillman and Salant).

17. Compensation will not be provided to subjects for participation.

18. There are no costs to participants.

19. Confidentiality: The survey results will remain anonymous and confidential to the extent permitted by law. We will not connect the survey participant’s name to the data collected. We will administer the survey using QUALTRICS, the official survey software at Oregon State University, which has a “web-link” survey distribution option that allows for complete confidentiality. No individual responses will be connected to identifying information (name, address, phone number) about the respondent. In addition, the codes will not be connected to their identities. All research data and materials will be stored for a minimum of three years post-study termination in the PI’s office in a locked cabinet during the study and for no more than five years post-completion. All research data and material will be available for audit purposes and will be destroyed.

20. Risks: The risks associated with the project are minimal to none. The survey questions do not request any sensitive information, and all participants will consented to participate. There is always a risk that a breach of confidentiality can occur, but we will take all precautions to avoid this.

21. Benefits: There are no immediate or direct benefits for participants. However by taking the survey, participants may become more aware of PPCP in the environment and learn about their stewardship, alternatives and proper ways to dispose of them. The knowledge gained from this project might guide future actions, applications of human dimensions research, education programs, areas of study, and policies to improve prevention of PPCP as emerging contaminants in watersheds.

22. Assessment of risk: benefit ratio: Risks are minimal. The potential benefits to individuals and society outweigh the risks.

23. Works Cited

AVMA, (2012). U.S. Pet Ownership & Demographics Sourcebook.

Boxall, A. B. (2004). The environmental side effects of medication. EMBO reports, 5(12), 1110.

Morace, J. L. (2012). Reconnaissance of Contaminants in Selected Wastewater-treatment-plant Effluent and Stormwater Runoff Entering the Columbia River, Columbia River Basin, Washington and Oregon, 2008-10. US Department of the Interior, US Geological Survey.

Salant, P., & Dillman, D. A. (1994). How to conduct your own survey (pp. 54-5). New York: Wiley.

Teleosis (2007). Green Pharmacy program. Teleosis Institute.

Attachments:

1. Recruitment:

(A) Contact with key informants

My name is Jennifer Lam and I am a graduate student in the Marine Resource Management program at Oregon State University.

I am working on a research project that looks at how pet owners use and dispose of pet pharmaceutical and personal care products. The research project is titled: "Understanding Pet Owner Knowledge and Behaviors Regarding Pharmaceuticals and Personal Care Product Use and Disposal into the Environment". Professor Flaxen Conway and Dr. Sam Chan are the Principal Investigators leading this research project.

One of our target audience groups to engage in this research is [VETS (or) TEACHERS]. I am hopeful that we can count on you to send out a notice about this research project to your membership. I'm happy to provide a short notice, which includes an overview of the project and online survey link for members willing to participate. We certainly hope that members of your network will participate, as we believe that the information generated from the research will be of value to people facilitating information exchange on this

issue of emerging importance, and provide potential benefits to society and the environment.

To help us define the demographics of XXX, can you provide us some statistics on the geographic reach and membership make-up of XXX? About how many members are associated with the XXX mailing list? Please feel free to share additional ideas and ways that you might wish to stay engaged.

Thanks for your help,
Jen

(B) Narrative for notices to mailing lists (OPT IN):

Subject line: Are you a pet owner? Please participate in a study on the use and disposal of pet pharmaceuticals and personal care products!

Dear (EDUCATOR OR VETERINARY PROFESSIONAL),

My name is Jennifer Lam and I am a graduate student in the Marine Resource Management program at Oregon State University. I am working on a research project that looks at how pet owners use and dispose of pet pharmaceutical and personal care products. The research project is titled: Understanding Pet Owner Knowledge and Behaviors Regarding Pharmaceuticals and Personal Care Product Use and Disposal into the Environment. Professor Flaxen Conway and Dr. Sam Chan are the Principal Investigators leading this research project. To participate in the study is simple and requires two steps.

Step 1 is to contact us and let us know that you are interested in participating. To do this, use this link [OPT IN LINK] to confirm that you'd like to participate. Once you opt in (Step 1), I will send you an email with a unique ID code that will allow you to participate in the actual survey. The ID code is for survey tracking purposes only and all data will be summarized and shared as averages. The code you are given to enter is kept separately from your email address.

Step 2, the survey. This survey asks about pet ownership, consumer choices and actions, and the use and disposal of pharmaceuticals and personal care products. Please know that your responses to the survey will be kept confidential; the ID code is for tracking purposes only and all data will be summarized and shared as averages. We estimated that it will take about 15-30-minutes to complete the survey.

I would greatly appreciate your participation in this study. Please complete Step 1 by [DATE]

If you have questions about the purpose of this study, or if you have questions about submitting your questionnaire, please contact me, Jennifer Lam at lamj@onid.oregonstate.edu.

Thank you for your willingness and time to participate in this study!

Sincerely,
Jennifer Lam

(C) Email with code/survey link

Subject line: Research study on the use and disposal of pet pharmaceuticals and personal care products

Dear Pet Owner,

Thank you very much for taking the time to help out with my graduate research project titled: Understanding Pet Owner Knowledge and Behaviors Regarding Pharmaceuticals and Personal Care Product Use and Disposal into the Environment.

We truly appreciate your participation in this research. Your responses to this 15-30-minute online survey are extremely valuable in developing an understanding of pharmaceuticals and personal care products (PPCP) use and disposal, and will guide future educational outreach and engagement efforts to reduce impacts of PPCP on the environment.

Your participation is voluntary and although we prefer you answer all questions, this is not required. Your responses will be completely confidential.

To get to the survey simply follow this link [LINK SURVEY].

The first question on the survey asks for a code. Special precautions have been established to protect the confidentiality of your responses. The code you are given to enter is kept separately from your email address. Please enter this in exactly as it is listed here. Your unique code is XXX.

Thanks you again for your willingness and time to participate in this study! Let us know if you would like a copy of the final report as we would be happy to send you an electronic version.

If you have any questions about the research, please contact Jennifer Lam via email at lamj@onid.oregonstate.edu or Flaxen Conway via email at fconway@coas.oregonstate.edu, phone at (541) 737-1339. If you have questions about your rights or welfare as a participant, contact the Oregon State University Institutional Review Board (IRB) Office, at (541) 737-8008 or by email at IRB@oregonstate.edu.

Sincerely,
Jennifer Lam

(D) Reminder to non-respondents

Email Subject Line Reminder: Please participate in the research study on the use and disposal of pet pharmaceuticals and personal care products!

Dear Pet Owner,

I initially contacted you on (DATE) to participate in a research project that looks at how pet owners use and dispose of pet pharmaceuticals and personal care products (PPCP). The research project is titled: Understanding Pet Owner Knowledge and Behaviors Regarding Pharmaceuticals and Personal Care Product Use and Disposal into the Environment. I sent out the survey two weeks ago and have already received many responses.

We recognize that your time is valuable and we would truly appreciate it if you would please take ~15-30 minutes to share your perspectives. The survey will close on [insert date] and we need your input before then. Your response is extremely valuable in developing an understanding of PPCP use and disposal, and will guide future educational outreach and engagement efforts to reduce impacts of PPCP on the environment.

To get to the survey simply follow this link [LINK SURVEY].

The first question on the survey asks for a code. Special precautions have been established to protect the confidentiality of your responses. The code you are given to enter is kept separately from your email address. Please enter this in exactly as it is listed here. Your unique code is XXX.

Thanks you again for your willingness and time to participate in this study! Let us know if you would like a copy of the final report as we would be happy to send you an electronic version.

If you have any questions about the research, please contact Jennifer Lam via email at lamj@onid.oregonstate.edu or Flaxen Conway via email at fconway@coas.oregonstate.edu, phone at (541) 737-1339. If you have questions about your rights or welfare as a participant, contact the Oregon State University Institutional Review Board (IRB) Office, at (541) 737-8008 or by email at IRB@oregonstate.edu.

Sincerely,
Jennifer Lam

2. Survey(s)
 - Opt in Survey
 - General Survey

Appendix D. Online Survey Instrument – Opt in survey for Educators

Thank you again for your willingness and interest to participate in our research project: “Understanding Pet Owner Knowledge and Behaviors Regarding Pharmaceuticals and Personal Care Products (PPCPs) Use and Disposal into the Environment” We’re asking you to complete this voluntary survey to find out if you’re eligible to participate in our study. This survey will take about 5 minutes to complete. There are no foreseeable risks or benefits for completing this opt in survey. These questions are only for statistical purposes and to determine eligibility, and will remain completely confidential to the extent permitted by the technology. If you’re not eligible for this study, we will discard your response. If you have any questions about the research, please contact Jennifer Lam via email at lamj@onid.oregonstate.edu or Flaxen Conway via email at fconway@coas.oregonstate.edu, phone at (541) 737-1339. If you have questions about your rights or welfare as a participant, contact the Oregon State University Institutional Review Board (IRB) Office, at (541) 737-8008 or by email at IRB@oregonstate.edu.

Step 1 Complete this short opt-in survey. Once this is completed you will receive a special code and link to the survey within 72 hours. Navigate through the survey pages by clicking on the arrow key at the bottom of the screen.

Q1 Are you a pet owner?

Yes (1)

No (2)

If No Is Selected, Then Skip To End of Survey

Q2 Please enter the email address (where we will send the survey link/code to):

Q3 Please indicate THE STATE where you currently reside:

Washington (1)

Oregon (2)

California (3)

Other (please specify): (4) _____

Q4 How would you describe the geographic setting/location of your residence?

Rural (1)

Suburban (2)

Urban (3)

Q5 Do you primarily teach in an informal setting (e.g. zoo, aquaria, science center, museum, park)?

Yes (1)

No (2)

If Yes Is Selected, Then Skip To If yes, what setting do you currently...If No Is Selected, Then Skip To Do you teach in a formal setting?

Q5a If yes, what setting do you currently teach?

museum (1)
 aquaria (2)
 zoo (3)
 science center (4)
 park (5)
 other (please specify) (6) _____

Q6 Do you teach in a formal setting?

Yes (1)

No (2)

If Yes Is Selected, Then Skip To If yes, what grade or level do you cu...If No Is Selected, Then Skip To Which best describes the topic area

Q6a If yes, what grade or level do you currently teach?

Kindergarten (1)
 Grades 1-5 (2)
 Grades 6-8 (3)
 Grades 9-12 (4)
 Community College or University (5)
 Other (please specify) (6) _____

Q7 Which best describes the topic area that you currently teach? (Select one only)

Science only (1)

Science combined with other subjects (2)

Non- Science only / other (please specify) (3) _____

Q8 How many years of experience have you had in your profession?

Less than 1 year (1)

1- 3 years (2)

4-6 years (3)

More than 6 years (4)

Q9 What is your age?

18 – 24 (1)

25 – 34 (2)

35 – 44 (3)

45 – 54 (4)

55 – 64 (5)

65+ (6)

Q10 What is your gender?

Male (1)

Female (2)

You will receive an email with an online survey link and a unique ID code within 72 hours. Please select the advance arrow to submit your answers. Thank you for your participation.

Appendix E. Online Survey Instrument – Opt in survey for Veterinary Care Professionals

[Note: same introduction and consent information as opt-in survey for educators]

Q1 Are you a pet owner?

Yes (1)

No (2)

If No Is Selected, Then Skip To End of Survey

Q2 Please enter the email address (where we will send the survey link/code to):

Q3 Please indicate THE STATE where you currently reside:

Washington (1)

Oregon (2)

California (3)

Other (please specify): (4) _____

Q4 How would you describe the geographic setting/location of your residence?

Rural (1)

Suburban (2)

Urban (3)

Q5 Do you practice in the professional veterinary field (e.g. practice medicine and see patients, interact with clinicians)?

Yes (1)

No (2)

If Yes Is Selected, Then Skip To If yes, what position do you hold? If No Is Selected, Then Skip To If no, what best describes your field:

Q5a If yes, what position do you hold?

veterinarian (DVM) (1)

veterinary allied professional staff (i.e. technician, assistant) (2)

animal health company position (3)

other (please specify): (4) _____

Q6 Which area below best describes the veterinary care (or the area you most work in)?

Companion animal practice (1)

Food animal practice (2)

Exotic animal practice (3)

Government practice (4)

Research (5)

Academia (6)

If Companion animal practice Is Displayed, Then Skip To How many years of experience have you...

Q5b If no, what best describes your field:

pet boarding kennel business owner/staff (1)

pet grooming business owner/staff (2)

other (please specify) (3) _____

Q7 How many years of experience have you had in your profession?

Less than 1 year (1)

1- 3 years (2)

4-6 years (3)

More than 6 years (4)

Q8 What is your age?

18 – 24 (1)

25 – 34 (2)

35 – 44 (3)

45 – 54 (4)

55 – 64 (5)

65+ (6)

Q9 What is your gender?

Male (1)

Female (2)

You will receive an email with an online survey link and a unique ID code within 72 hours. Please select the advance arrow to submit your answers. Thank you for your participation.

Appendix F. General Survey Instrument

Q1 Thank you again for your willingness and interest to participate in our research project: “Understanding Pet Owner Knowledge and Behaviors Regarding Pharmaceuticals and Personal Care Products (PPCPs) Use and Disposal into the Environment” We truly appreciate your participation in this research. Your responses to this 15-30-minute online survey are extremely valuable in developing an understanding of pharmaceuticals and personal care products (PPCP) use and disposal, and will guide future educational outreach and engagement efforts to reduce impacts of PPCP on the environment. Navigate through the survey pages by clicking on the arrow key at the bottom of the screen.

Q2 Informed consent PLEASE READ: You are being invited to take part in a research study about the use and disposal of pet pharmaceuticals and personal care products (PPCPs) because you are at least 18 years old and a pet owner. You can provide valuable insights. The following survey should take about 15-30 minutes to complete. The purpose of this study is to learn how pet owners use and dispose of pet PPCPs. The findings from this research will guide future educational outreach and engagement efforts to reduce impacts of PPCPs on the environment. They will also be used for publications, presentations at conferences, and for graduate student Jennifer Lam's master thesis. We truly appreciate your participation in this study. Your participation is voluntary and although we prefer you answer all questions, this is not required. All responses you provide will be kept confidential to the extent permitted by law and technology, secured in a password-protected computer data base. No person or identifying information will be associated with your responses, but there's a chance that we could accidentally disclose information that identifies you. Please be assured that we take all precautions to keep all participants confidential. This study is not designed to benefit you directly but we believe that it will inform the science and use of pet PPCPs. If you do not want to participate and do not wish to be contacted further, please let us know. Should you agree to participate – and we hope you do – please indicate by selecting the “I agree” button, enter your code, and proceed with the survey. If you have any questions about the research, please contact Jennifer Lam via email at lamj@onid.oregonstate.edu or Flaxen Conway via email at fconway@coas.oregonstate.edu, phone at (541) 737-1339. If you have questions about your rights or welfare as a participant, contact the Oregon State University Institutional Review Board (IRB) Office, at (541) 737-8008 or by email at IRB@oregonstate.edu. You are welcome to print this disclosure statement for your records.

I Agree (1)

I Disagree (2)

If I Disagree Is Selected, Then Skip to End of Survey If I Agree Is Selected, Then Skip to
Please enter your unique ID code below:

Q3 Please enter your unique ID code below from the email (code format is 3 letters followed by 4 numbers, no space in between: ex. ABC1234):

Q4 Below are definitions for some of the terms used in this survey. Pharmaceuticals and personal care products (PPCPs): Pharmaceuticals: Simply stated, pharmaceuticals are medicines or supplements/vitamins that promote health and well-being that either require a prescription to obtain or are available “over-the-counter” without a prescription. They can be in the solid, liquid or aerosol form. Personal Care Products: These can include products used for personal hygiene or beauty such as soaps, facial/body cleansers, shampoos, conditioners, lotions, cosmetics, insect repellents, skin protectants, and fragrances. Pet personal care products can include flea shampoos and flea collars. Unused: This term includes partially or completely unused, unwanted, wasted, or expired substances that ultimately require disposal.

Q5 For the pet portion of the survey, please select one of your pets from the list below to base your responses on.

- dog (1)
- cat (2)
- fish (3)
- bird (4)
- small mammal (e.g. guinea pig, hamster) (5)
- reptile (6)
- horse (7)
- other (please specify): (8) _____

Q6 Please share up to 3 motivations for acquiring a pet:

- companionship (1)
- security (2)
- pre-cursor to children (3)
- save the pet's life (5)
- special needs (i.e. seeing eye dog, therapy animal) (6)
- work needs (7)
- enhance sense of responsibility (10)
- other (please specify): (11) _____
- Does not apply (12)

Q7 Please share up to 3 concerns you have for your pet's wellbeing:

- health/life expectancy (1)
- energy level (2)
- weight/physical activity (3)
- happiness/demeanor (4)
- cleanliness/hygiene (5)
- behavioral issues (6)
- comfort level with other people and animals (7)
- ability to entertain themselves (8)
- safety (9)
- other (please specify): (10) _____
- Does not apply (11)

Q8 Please choose up to 3 environments where you prefer your pets to recreate:

- free-range, clean and open outdoor spaces (1)
- formal dog park (2)
- access to water for play (3)
- access to outdoors for cats (4)
- access to indoors only (5)
- places with similar animals (6)
- natural spaces and waterways (7)
- other (please specify): (9) _____
- Does not apply (8)

Q9 When thinking about these environments, what aspects make them healthy for your pets? Choose up to 3

- clean water and air (1)
- trees and shade (2)
- vast expanse of open fields (3)
- inside with play structures (4)
- diversity from home environment (5)
- friendly people and other pets to socialize (6)
- free from extreme weather (7)
- safety from predators (8)
- other (please specify): (9) _____
- Does not apply (10)

Q10 Now consider all pets in your household. Do you ever use pharmaceutical and personal care products (PPCPs) on pets in your household?

Yes (1)

No (2)

If Yes Is Selected, Then Skip to If yes, how many different types or b...If No Is Selected, Then Skip to End of Block

Q11 If you do use PPCPs on your pet, how many different types or brands of PPCPs do you have available to use on your pets?

0 (5)

1-3 (1)

4-6 (2)

7-10 (3)

10 or more (4)

Q12 How many PPCPs do you usually use on your pet during one

occasion? Pharmaceuticals: Simply stated, pharmaceuticals are medicines or supplements/vitamins that promote health and well-being that either require a prescription to obtain or are available “over-the-counter” without a prescription. They can

be in the solid, liquid or aerosol form. Personal Care Products: These can include products used for personal hygiene or beauty such as soaps, facial/body cleansers, shampoos, conditioners, lotions, cosmetics, insect repellents, skin protectants, and fragrances. Pet personal care products can include flea shampoos, flea collars, etc.

pet usually uses 3 or less different types at one time (1)

pet usually uses 4-6 different types at one time (2)

pet usually uses more than 7 different types at one time (3)

Q13 Which of the following most often applies to your pet's pharmaceuticals?

finish completely; none to dispose (1)

keep unused medicines until expires, then dispose (2)

dispose when treatment is completed (3)

store them in the house indefinitely (4)

Q14 Approximately, what proportion of the pet pharmaceuticals goes unused in your household? [Note: "Proportion" relates to the volume that go unused, compared to the total. We understand that you may not keep records of this. If it would help, please consider the amount of all pet pharmaceuticals that go unused in your household]

No pet pharmaceuticals in this household ever go unused (1)

1-25% of pet pharmaceuticals in this household usually go unused (2)

26-50% of pet pharmaceuticals in this household usually go unused (3)

>50% of pet pharmaceuticals in this household usually go unused (4)

Q15 Which of the following most often applies to your pet's personal care products?

finish completely; none to dispose (1)

keep unused personal care products until expires, then dispose (2)

store them in the house indefinitely (3)

Q16 Approximately, what proportion of the pet personal care products go unused in your household? [Note: "Proportion" relates to the volume that was ultimately not used, compared to the total. We understand that you may not keep records of this. If it would help, please consider the amount of pet personal care products that go unused in your household]

No pet personal care products in this household ever go unused (1)

1-25% of pet personal care products in this household usually go unused (2)

26-50% of pet personal care products in this household usually go unused (3)

>50% of pet personal care products in this household usually go unused (4)

I don't know (5)

Q17 Have you purposely bought or considered buying pet personal care products which are designed to be environmentally friendly (e.g. products that have reduced, minimal, or no harm at all upon the environment)

Yes (1)

No (2)

If No Is Selected, Then Skip To If no, please specify why: If Yes Is Selected, Then Skip To End of Block

Q18 If you do not purposely buy or consider buying environmentally friendly pet personal care products, please specify why:

reduced performance (1)

product appearance (2)

too expensive (3)

not aware of any such products (4)

other (please specify): (5) _____

Q19 Please share how likely the following factors influence your decision on how to dispose of pet PPCPs in your household.

	Very Unlikely (1)	Unlikely (2)	Neutral (3)	Likely (4)	Very Likely (5)
Convenience/ease of disposal (1)	<input type="radio"/>				
Heard that it's better to flush pet PPCPs (2)	<input type="radio"/>				
Do what's most acceptable to my friends, family (3)	<input type="radio"/>				
Go with the flow. Do what the majority regard as acceptable (4)	<input type="radio"/>				
Do what is financially affordable (5)	<input type="radio"/>				
Desire to avoid risk of accidental poisoning (6)	<input type="radio"/>				
Desire to avoid risk of misuse/abuse (7)	<input type="radio"/>				
Desire to minimize pet PPCPs in water (8)	<input type="radio"/>				
Desire to minimize pet PPCPs in landfills (9)	<input type="radio"/>				
Follow what's legally required (10)	<input type="radio"/>				
Purchase only minimum amount of PPCPs for what my pet might need (11)	<input type="radio"/>				

Q20 How would you rate the influence of these activities on your decisions to take positive actions for protecting the environment? For each activity, please select if it has a major influence, a minor influence, or no influence at all.

	No influence (1)	Minor influence (2)	Major influence (3)
Financial incentive/reward (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Financial penalty (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
See people I know and trust taking action (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
People I know encourage me to take action (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hear people talking to others about the dangers of not taking action (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Learn about scientific studies on the consequences of a certain activity and positive actions I can take (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
See news media coverage encouraging me to take action (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
See ads or public notices encouraging me to take action (8)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Government agencies encourage me to take action (9)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My professional organization encourages me to take action (e.g. AVMA, NSTA, NAME) (10)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q21 Please indicate if you agree, disagree, or are neutral with the following statements:

	Disagree (1)	Neutral (2)	Agree (3)
Improper disposal of unused pet PPCPs can threaten the health of our water and the environment (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Improper disposal of unused human PPCPs can threaten the health of our water and the environment. (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
PPCPs in air, water, and soil can be a problem for me and my family. (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
PPCPs in air, water, and soil can be a problem for other species of plants and animals (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"I feel a personal obligation to take action to prevent PPCPs in the environment." (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"Pet waste is a source of pollution in lakes, rivers, and streams." (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"I take positive steps to live an environmentally friendly life." (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"If others don't take steps to live an environmentally friendly life then my actions won't matter." (8)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"Evidence of native fish being impacted by low levels of PPCPs detected in our watersheds would be a concern to me" (9)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q22 Do your decisions and actions regarding the purchase, use, and disposal of pet PPCPs extend to human PPCPs? Pharmaceuticals: Simply stated, pharmaceuticals are medicines or supplements/vitamins that promote health and well-being that either require a prescription to obtain or are available “over-the-counter” without a prescription. They can be in the solid, liquid or aerosol form. Personal Care Products: These can include products used for personal hygiene or beauty such as soaps, facial/body cleansers, shampoos, conditioners, lotions, cosmetics, insect repellents, skin protectants, and fragrances. Pet personal care products can include flea shampoos and flea collars.

Yes (1)

No (2)

Sometimes (3)

Q23 I purchase human PPCPs which are designed to be environmental friendly (e.g. products that have reduced, minimal, or no harm at all upon the environment).

Yes (1)

No (2)

Sometimes (3)

Q24 Now consider your own use and disposal of PPCPs. How do you usually dispose of your unused pharmaceuticals? (Choose up to 3)

Dispose down sink/toilet (1)

Dispose in garbage (2)

Mix with kitty litter or coffee grounds and then dispose in garbage (3)

Return to drop off boxes at law enforcement offices (4)

Give them to others (5)

Dispose them at regular community medicine collection event (6)

Return to health care provider (e.g., physician, pharmacist) (7)

I never have unused pharmaceuticals (8)

I keep them indefinitely (10)

Other (please specify): (9) _____

Q25 How do you believe the majority of others dispose their unused pharmaceuticals? (Choose up to 3)

- Dispose down sink/toilet (1)
- Dispose in garbage (2)
- Mix with kitty litter or coffee grounds and then dispose in garbage (3)
- Return to drop off boxes at law enforcement offices (4)
- Give them to others (5)
- Dispose them at regular community medicine collection event (6)
- Return to health care provider (e.g., physician, pharmacist) (7)
- I have no idea what other people do (8)
- Keep them indefinitely (10)
- Other (please specify): (9) _____

Q26 How do you usually dispose of your unused personal care products? (Choose up to 3)

- Dispose down sink/toilet (1)
- Dispose in garbage (2)
- Give them to others (3)
- Return to health care provider (e.g., physician, pharmacist) (4)
- I never have unused personal care products (5)
- I keep them indefinitely (7)
- Other (please specify): (6) _____

Q27 What would help you to best choose, use, and dispose of PPCPs in a more environmentally responsible way? (Choose up to 3)

- More environmentally friendly, but effective alternatives (1)
- Outreach and education on best practices for PPCPs stewardship from trusted sources (2)
- Take back collection events (3)
- Unused PPCPs return envelopes by mail (4)
- Retailer/manufacturer management collection program (5)
- Drop-off collection boxes (6)
- Regulations that would make it simpler for me to safely dispose of or return PPCPs (7)
- Please share/explain any other potential options: (8) _____

Q28 Where might be the first three places you look for information on pet PPCPs disposal?

- Advice from friends, neighbors, relatives (1)
- Recommendation from veterinarian (2)
- Read the product information on package (3)
- Advice from pet store (4)
- Internet (5)
- Government agency (6)
- Public utility (e.g. water provider, disposal company, public health) (7)
- I don't look for this information (8)

Q29 How would you prefer to learn more information on how to dispose of pet PPCPs? (Choose up to 5)

- Internet (1)
- Email (2)
- TV (3)
- Radio (4)
- Physical Magazine/Newspaper (5)
- Poster/Informational brochure (6)
- Health care provider (e.g., pharmacist, veterinarian or other veterinary staff) (7)
- Organization aligned with my profession (e.g. American veterinary association, teachers associations) (8)
- Pet insurance company (9)
- Law enforcement (10)
- Pet PPCPs product label (11)
- Garbage/disposal company (12)
- Pet store (13)
- Universities/extension (14)
- Educators at public schools (15)
- Informal learning centers (e.g. science museums, zoos, aquaria) (16)
- Trade shows (17)
- I'm not interested in learning more information on pet PPCPs disposal (18)

Q30 How do you usually dispose of your pet's unused pharmaceuticals? (Choose up to 3)]

- Dispose down sink/toilet (1)
- Dispose in garbage (2)
- Mix with kitty litter or coffee grounds and then dispose in garbage (3)
- Return to drop off boxes at law enforcement offices (4)
- Give them to other pet owners (5)
- Dispose them at regular community medicine collection event (6)
- Return to pet health care provider (e.g., pharmacist, veterinarian) (7)
- I never have unused pet pharmaceuticals (8)
- I keep them indefinitely (10)
- Other (please specify): (9) _____

Q31 How do you believe the majority of other pet owners dispose their pet's unused pharmaceuticals? (Choose up to 3)

Dispose down sink/toilet (1)

Dispose in garbage (2)

Mix with kitty litter or coffee grounds and then dispose in garbage (3)

Return to drop off boxes at law enforcement offices (4)

Give them to other pet owners (5)

Dispose them at regular community medicine collection event (6)

Return to pet health care provider (e.g., pharmacist, veterinarian) (7)

I have no idea what other people do (8)

Keep them indefinitely (10)

Other (please specify): (9) _____

Q32 How do you usually dispose of your pet's unused personal care products? (Choose up to 3)

Dispose down sink/toilet (1)

Dispose in garbage (2)

Give them to other pet owners (3)

Return to pet health care provider (e.g., pharmacist, veterinarian) (4)

I never have unused pet personal care products (5)

I keep them indefinitely (7)

Other (please specify): (6) _____

Q33 Now consider your feelings about the environment in general. How well informed would you consider yourself to be concerning environmental issues in your state?

not informed (1)

somewhat informed (2)

informed (3)

very well informed (4)

Q34 Please share any additional comments, questions, or ideas on the topics addressed in this survey:

[NOTE: The following are additional questions asked only to the veterinary care professional respondents]

Q35 Now looking at your profession: The American Veterinary Medical Association (AVMA) has practices for pharmaceutical disposal: <https://www.avma.org/KB/Policies/Pages/Best-Management-Practices-for-Pharmaceutical-Disposal.aspx>. **What percent of your appointments do you discuss with your clients (pet owners) on pharmaceutical disposal methods?** (Click on the sliding tab below to select what you estimate to be the percentage of appointments where you share and/or discuss pharmaceutical disposal)

_____ Appointments where pharmaceutical disposal methods are discussed (1)

Q36 What percent of your appointments do you educate your clients (pet owners) on personal care product choice and disposal methods? (Click on the sliding tab below to select what you estimate to be the percentage of appointments where you share and/or discuss personal care product choice and disposal methods).

_____ Appointments where personal care product choice and disposal methods are discussed (1)

Q37 What barriers (if any) do you encounter in conveying and discussing pharmaceutical disposal and personal care product choice and disposal information with your clients?

Q38 What solutions or actions can assist you in better conveying and discussing pharmaceutical disposal and personal care product choice and disposal information with your clients?

