

TEACHERS' TOPICS

A Lecture About Pharmaceuticals Used in Animal Patients

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Objectives. To implement a lecture on interesting and clinically relevant facts about animal patients to engage students in a veterinary therapeutics course.

Design. Active-learning methods were used to introduce students enrolled in a 2-credit-hour elective course in veterinary therapeutics to critical yet little known facts pertaining to veterinary informatics, pharmacology, pharmacotherapy, and toxicology resources.

Assessment. Precourse and postcourse learning surveys were conducted and showed that students had retained clinically relevant facts about pharmaceutical use in animal patients at the end of the course. Student performance on weekly quizzes, discussion board postings, and 2 examinations also suggested comprehension and retention of course content.

Conclusion. Using active-learning methods to educate pharmacy students in veterinary therapeutics is an effective way of preparing them to treat the "4-legged patients" they will likely encounter in community pharmacy practice.

Keywords: veterinary pharmacy, veterinary therapeutics, active-learning methods, animal patients

INTRODUCTION

There has been a contemporary call from the veterinary medical community for *One Medicine*, the blending of veterinary medicine and human medicine for the benefit of public health and to better serve both human and animal patients.¹ From a clinical pharmacy perspective, veterinary medicine and human medicine complement each other, with the human-trained pharmacist uniquely positioned to educate and serve veterinarians and animal owners.

Opportunities for the practical application of One Medicine can occur in community pharmacy settings as most pharmacists practicing in a community setting have been presented with prescriptions for animal patients at some time during their career. The use of human-labeled pharmaceuticals prescribed in an off-label manner to treat companion animal disease states is a viable option for veterinary medicine. Veterinarians outsource more prescriptions to community pharmacists now than in the past; inventory control, high drug costs, and the need for compounded drug therapies have contributed to this shift. Veterinary medicine does not have the vast array of Food and Drug Administration (FDA)-approved products to

choose from that human medical practitioners have. Thus, pharmacists who receive veterinary prescriptions often find their knowledge of veterinary drugs, indications, dosages, disease states, and therapeutic monitoring parameters challenged.

Veterinary pharmacy as a specialty practice is a growing area in the United States and pharmacy students are interested in obtaining veterinary-specific knowledge and skills. The growth in veterinary pharmacy has allowed pharmacists to apply their drug knowledge resources to veterinary situations. Pharmacists can advise veterinarians of new developments in human pharmaceuticals and discuss the therapeutic advantages or disadvantages of extra-label usage with veterinarians. Many pharmacists have easy access to text or Internet-based informatics that can be used to supply pertinent drug information to veterinarians. As one of the most accessible health care professionals, pharmacists can provide consultation and education to animal owners on pharmaceuticals and on animal disease states that have similar monitoring parameters to human disease states.

To best prepare pharmacy students to support and participate in One Medicine, veterinary-specific education within the pharmacy curriculum is needed. Such education can be provided in the form of didactic courses and/or advanced pharmacy practice experiences (APPEs). Creighton University offers a 2-credit hour, elective course in veterinary therapeutics as preparation for interested students. The objective of the course is to create

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a learning environment where students can obtain knowledge and skills that can positively impact veterinary patient outcomes.

DESIGN

The Veterinary Therapeutics course was introduced in 2002 and content focused on 5 main areas: veterinary disease states and supporting informatics, legal and regulatory issues, veterinary pharmaceutical classes, public health issues, and current topics affecting veterinary pharmacy. There was also a service-learning requirement in the course in which students spend time in a veterinary clinic or humane society to practically apply course content directly to animal patients and veterinary medicine. Course objectives are listed in Table 1.

The first lecture presented in the course was titled “Did You Know. . .?” and highlighted clinically relevant yet little known facts about veterinary, informatics, pharmacology, pharmacotherapy, and toxicology resources. The material was presented utilizing the active-learning methods of group discussion, professional reflection, and personal experience. Humorous examples and anecdotes from the instructor’s personal experience were infused into the curriculum to maintain the students’ interest, increase their comfort level, and illustrate how furry, 4-legged patients could be a part of their future pharmacy practice.

Clinical facts were presented to support the first learning objective: recognize veterinary pharmacy as a specialized area within pharmacy practice. The purpose for presenting the “Did You Know. . .?” information was to demonstrate the uniqueness of veterinary pharmacy, the number and different types of veterinary species that need pharmacotherapy, farm to fork issues affecting food animal operations and the wholesomeness of our food supply, and the vast knowledge gap that can exist for pharmacists who have not had the opportunity to obtain

basic knowledge and skills regarding veterinary pharmacy. A selection of clinical facts from the “Did You Know. . .?” section is presented in Table 2.

After each fact was presented, class discussion was encouraged. The instructor verbally surveyed the students for a level of understanding, asked open-ended questions, and encouraged students to share personal experiences. Veterinary medicine can present many humorous challenges and situations, for example, describing the technique for or viewing an Internet-based video clip on “how to pill a cat” presented the information in an entertaining format and brought new meaning to the term “patient counseling” for students. Suggesting that animal owners disguise a tablet in a piece of cheese or spoonful of peanut butter are patient compliance suggestions that can be funny at times, especially when contrasted to patient counseling techniques or compliance tips used for the same medication in human patients.

The “Did You Know. . .?” information provided a focused introduction to the unique nature of veterinary pharmacy, with individual facts discussed again later in the semester. After the presentation of course content, students were required to complete weekly self-assessment quizzes as well as 2 examinations designed to reinforce clinical knowledge and facts.

EVALUATION AND ASSESSMENT

One hundred forty-two students were enrolled in the 2008 offering of the course. Both quantitative and qualitative methods were utilized to assess student learning outcomes. All students were required to complete a 25-question precourse survey instrument to measure their confidence levels on clinical veterinary facts, disease states, medication therapy options, public health topics, veterinary informatic resources, and legal issues. All students were also required to complete an identical 25-question postcourse survey instrument to measure their

Table 1. Objectives for a Veterinary Therapeutics Course

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1. Recognize veterinary pharmacy as a specialized area within pharmacy practice.
 2. Recall and explain the unique legal and regulatory restrictions applicable to veterinary medicine, food-animal medicine and compounding for animal patients by pharmacists and veterinarians.
 3. Compare and contrast the most common disease states affecting companion and food-animals to the corresponding human disease equivalent with particular emphasis on pharmacotherapy decision-making.
 4. Communicate effectively with animal owners and veterinarians to: meet state-mandated counseling requirements, to enhance medication compliance, solve drug administration problems, and to recommend appropriate drug therapy choices for the betterment of animal health.
 5. Develop “non-linear” critical thinking skills needed to when dealing with multiple animal species in unique circumstances to solve pharmaceutical-related problems.
 6. Demonstrate caring attitudes and behaviors with regards to illness behaviors exhibited by animals and animal owners.
 7. Identify an animal patient-pharmacist relationship in the context of a therapeutic relationship
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Table 2. Clinical Facts Included in the “Did You Know...?” Section of a Veterinary Therapeutics Course

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- Acetaminophen is toxic to cats.
 - The sig abbreviation “SID” means once-a-day in veterinary medicine.
 - The dose of levothyroxine for hypothyroidism in dogs is 4-5 times that of humans.
 - There is a veterinary toxicology resource available to pharmacists when animal patients ingest unknown/large quantities of human medications.
 - Chocolate can be toxic to dogs.
 - Diazepam can be used to stimulate the appetites of cats.
 - Veterinary prescriptions presented in a community pharmacy setting must comply with the same dispensing, drug utilization review, labeling and counseling requirements as human prescriptions.
 - Many veterinary labeled antibiotics (penicillin, tetracycline, erythromycin, neomycin) approved for use in food animals, are non-prescription items.
 - There is a 5 pound bucket of pseudoephedrine available (Tri-Hist Granules, prescription status, List 1 Chemical) to treat horses with chronic obstructive pulmonary disorders.
 - Dimenhydrinate can be used for the prevention and treatment of motion sickness in cats and dogs.
 - There is a drug to treat obesity in dogs.
 - Fluoxetine (Prozac) now comes in an FDA-approved form to treat separation anxiety in dogs.
 - A drug called apomorphine can be administered topically in the eye to induce vomiting in dogs.
 - Carfentanyl, an ultrapotent narcotic that is 10,000 times stronger than morphine, is used by veterinarians for chemical immobilization of wildlife and large hoofstock.
 - Fentanyl patches are commonly used in canines and felines for pain control.
 - Metronidazole, cephalexin, cefazolin, ampicillin are human labeled anti-infectives commonly used in companion animals.
 - Virtually all the cancer pharmacotherapy options for use in companion animals are human labeled drugs.
 - Sildenafil (Viagra) can be used to treat pulmonary hypertension in canines and felines.
 - Phenobarbital is the drug of choice to treat seizures in dogs and cats.
 - Ketamine, a commonly used veterinary labeled drug available in 100mg/mL, can be a drug of abuse in humans.
 - There are many sub-specialties within veterinary medicine (internal medicine, oncology, ophthalmology) much like human medicine.
 - Internet and mail-order veterinary pharmacies are a common source for obtaining veterinary chronic and preventative medications for dogs and cats.
 - All prescription drugs used in dairy cattle must be labeled by the authorizing veterinarian or a pharmacist. And, all raw milk is tested for the presence of drug residues.
 - The proper use of injectable drugs in food animals is a significant factor that contributes to the safety and wholesomeness of our food supply.
 - Several human labeled insulins are used to treat diabetes in dogs and cats.
 - A number of veterinary drugs; 7% iodine solution/tinctures, phenylpropanolamine and pseudoephedrine, can be used in the illicit manufacture of methamphetamine.
 - There are veterinary wholesale drug distributors that provide pharmaceuticals, vaccines and other supplies to veterinary clinics. Much like human wholesale drug distributors supply pharmacies.
 - One of the most common and useful drug information resources for pharmacists and veterinarians alike is the Veterinary Drug Handbook by Donald Plumb, PharmD. It is called “the virus” in veterinary medicine because it is everywhere.
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knowledge or confidence level on the same topics after completing the course. The instrument utilized a 5-point Likert scale (1 = strongly agree, 2 = agree, 3 = neutral, 4 = disagree, 5 = strongly disagree) for responses. A 100% response rate (N = 142) was attained for both the pre-course and postcourse surveys. Table 3 lists the pre-course and postcourse median responses for selected questions

that best measured the learning outcomes from the “Did You Know...?” section. Postcourse median response scores were notably higher than the precourse scores, suggesting that students left the course with a measurable gain in veterinary pharmacy facts and knowledge.

Students were also required to post responses to discussion board questions 3 times during the semester

Table 3. Selected Questions from Precourse and Postcourse Surveys of Students Enrolled in a Veterinary Therapeutics Course (N=142)^a

Survey Question	Precourse Median Score ^b	Postcourse Median Score ^b
I find the subject matter of veterinary therapeutics interesting.	1.5	1.0
I am confident in my ability to explain current public health issues that involve veterinary pharmacy	4.5	1.0
I feel confident in my ability to meet state mandated counseling requirements for a medication(s) used in an animal patient.	4.5	1.5
I feel confident in my ability to utilize a text or internet reference to find a dosage for an animal patient.	3.5	1.5
I feel confident in my ability to determine if a compounded medication would be appropriate or inappropriate for use in companion animals	5.0	1.5

^a Combination of data from separate course offerings in the calendar year 2008

^b The assessment utilized a 5-point Likert scale (1 = strongly agree, 2 = agree, 3 = neutral, 4 = disagree, 5 = strongly disagree).

(N=142, 100% response rate). The first question posed to the students at the beginning of the semester, “What are your reasons for taking this course?” was intended to solicit insights on the students’ motivations for enrolling in the course. Midterm questions, “How has this course applied concepts gained in previous pharmacy courses to the subject of veterinary therapeutics?” and “List 3 things that you have learned so far,” were intended to have students volunteer their thoughts on specific new knowledge they had gained from the course.

A theme analysis conducted on the answers and reflections to the discussion board questions provided data that also supported the precourse and postcourse survey results of students retaining critical veterinary pharmacy facts. In particular, responses to the question of “List 3 things you have learned” provided direct evidence that the students retained and were able to recall knowledge from the “Did You Know...?” section. The most frequent responses to these questions were facts and principles presented in the “Did You Know...? Topic, with the toxicity of acetaminophen to cats as the number one item listed. Students also expressed how their new knowledge of veterinary informatics would enhance their ability to problem-solve issues relating to veterinary disease states and pharmacotherapy.

A consistent theme shared by virtually all students was how “four-legged animals” can be their patients as well as human patients. Additionally, there was self-recognition by the students of the practical role of “Pharmacist as Educator” and how broad that role could be. Overall, students felt that the knowledge base gained would positively influence future veterinary pharmacy experiences.

Evidence of positive student learning outcomes related to the “Did You Know...?” section were demonstrated during numerous service-learning experiences at a local humane society under the direction of the instructor. Students easily recognized, identified, recalled and applied the clinical facts from the medication sheets attached to the animal’s kennel in the shelter. Students displayed knowledge in use via recognition of the sig abbreviation SID, the indications of commonly prescribed anti-infectives in dogs and cats, signs of veterinary disease states discussed in class, the use of controlled substances for severe pain control, and recognition of role the economics plays in veterinary medicine.

Quantitative and qualitative data from the evaluations revealed high course and instructor ratings, with the majority of positive comments directed at the teaching methods, service-learning component, and the focus on enduring knowledge.

End-of semester reflective questions; “What is the connection between this course and your role as a pharmacist?” and “What was different about this course compared to other courses that you have had in the pharmacy program?” solicited students’ thoughts about the relationship between course content and their perceptions of how they would utilize this new knowledge in future practice environments.

All students were required to submit evaluations for the course and the instructor.

DISCUSSION

Over 500 Creighton University students and approximately 425 visiting students² have enrolled in and completed the veterinary course since its inception. Although not all of these students will practice in a veterinary

pharmacy environment, the majority will practice in a community pharmacy setting where there is a high possibility they will need to care for animal patients at some point. These encounters probably will be the best opportunities for future pharmacists to practice and contribute to One Medicine.

The use of open discussions, reflection, and personal experiences served as an effective and enjoyable method of content delivery for the “Did You Know...?” topic. The instructor found humor in whatever subject matter was being taught and shared that within the lecture. This use of humor served to level the power differential that can exist in a classroom between instructor and students. Regardless of the educational topic, this teaching methodology and discussion approach can easily be adapted by other instructors who are teaching required or elective courses in their area of expertise. Some students immediately related to the material because of their personal experiences as pet owners. Many students owned or had owned companion animals that had been afflicted with a common veterinary disease state. Students from rural farming backgrounds were familiar with the disease states and conditions affecting production animal medicine and resulting antibiotic use.

Other students could relate to the clinical facts because of pharmacy work experience where they had seen veterinary prescriptions for levothyroxine, NPH insulin, or tramadol in a community pharmacy setting. Encouraging students to share their work experiences resulted in lively discussions where students recalled situations in a community pharmacy where a veterinary prescription was presented, and consequently challenged the knowledge resources of the attending pharmacist. Still other students may not be familiar with any of the clinical facts but find the information interesting and educational and a refreshing departure from an entirely human-focused curriculum.

An example of the need to problem solve and apply creative thinking skills during a discussion is illustrated by asking how the students would counsel the patient (animal owner) on the proper use of a prescribed medication. Are prescriptions written for animal patients exempt from state pharmacy practice act requirements to offer verbal counseling on a newly dispensed prescription? How should a pharmacist modify the delivery of drug information to the human owner? Where would a pharmacist obtain drug information about a human medication being prescribed for an animal patient so that they can accurately communicate drug facts and monitoring parameters to the animal owner? How do you explain to an owner how to “pill” a cat? Where could a pharmacist find Internet-based resources to give to the animal owner as a supplement to verbal counseling? All the questions posed are real challenges that a future pharmacist could

face if presented with a veterinary prescription in a community setting.

The focus on enduring knowledge (the most important pieces of information for long-term knowledge recall) was a major teaching method employed by the instructor and was appreciated by the students. Due to the amount of factual clinical knowledge that exists about veterinary disease states and drug therapies that are potentially applicable to hundreds of different animal species, it is impossible to educate pharmacy students on every aspect of medical management and medical care. Therefore, focusing on the most important clinically relevant facts that are applicable to a future pharmacist in community practice is a continual underlying pedagogical principle employed by the instructor. Faculty members recognize that students cannot know everything about every topic, so teaching students where and how to answer questions is critical to preparing them for future practice challenges. This principle is especially important in the instruction of students on veterinary pharmacy.

One potential long-term implication of this type of educational offering is that pharmacist driven education that uses thoughtful adaptation and application of human pharmacy practices to animal situations could provide economic and strategic advantages for progressive pharmaceutical organizations. The comprehensive drug knowledge and unique perspectives of pharmacists trained in veterinary therapeutics can be a valuable knowledge resource in the application of One Medicine to veterinary medicine and pharmacy practice for the ultimate benefit of both human and animal patients.

SUMMARY

A lecture on interesting and clinically relevant facts about animal patients was added to a veterinary therapeutics course, resulting in increased student interest and class participation. Active-learning methods, including class discussion, reflection, and sharing of humorous personal experiences, were used. Because community pharmacists need to have a general knowledge of veterinary therapeutics but cannot be expected to know or recall all information presented in a single pharmacy school course, the instructor focused on students gaining enduring knowledge.

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