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# Educational Outcomes in Vet 101; A Continuing Education Course for Practicing Pharmacists in Veterinary Therapeutics

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**The purpose of the study was to assess the effectiveness of a continuing education (CE) course in veterinary therapeutics by measuring the cognitive knowledge of pharmacists as shown in their confidence level to: explain common animal disease states, summarize veterinary pharmacotherapy options, and explain important regulatory documents that influence the practice of veterinary pharmacy.**

**Both quantitative and qualitative methods were used to assess the effectiveness of the CE curriculum. A one group pre-post quasi-experimental design was used to evaluate the confidence level and application skills of the pharmacist-students. Reflective commentary was also collected.**

**Cognitive post-course scores improved significantly over the pre-course scores on all 26 pre- and post-course survey questions. The Wilcoxon signed-ranks analysis for each question resulted in statistically significant levels thereby indicating that the increase in the cognitive measure was not due to error. The results show that an online continuing education course in veterinary therapeutics for practicing pharmacists can be used to increase the confidence level in the pharmacist's cognitive knowledge and skills after completion of the curriculum. The online offering of this course appears to be an effective method to educate pharmacists on topics specific to veterinary pharmacy.**

*Keywords*: Continuing education; Educational outcomes; Veterinary compounding; Veterinary therapeutics; Veterinary pharmacy

## INTRODUCTION

The practice of veterinary pharmacy is a relatively new concept in the United States. A standard, universally adopted definition of veterinary pharmacy does not exist. One can infer a definition of veterinary pharmacy from the current practice environments. The oldest and most established veterinary pharmacy practice environment is within the in-patient pharmacies in the veterinary teaching hospitals in the United States and Canada (Society of Veterinary Hospital Pharmacists mission statement; Gibbs, 1990). Veterinary pharmacists can also be found practicing in academia, government and community environments.

There has been tremendous growth in the number of pharmacists offering products and services to veterinarians and animal owners from within the independent community pharmacy ranks. To quantify the numbers of pharmacists, pharmacies and supporting organizations offering veterinary products and services, an internet search utilizing the search terms "veterinary compounding" will yield 11,500 hits (Google search engine, accessed July 2003). Most pharmacists practicing in a community setting have been presented with prescriptions for animal patients at some time during the course of their career. Prior to the early 1990s, filling these prescriptions was mostly an occasional task that involved dispensing a commercially available product to the animal owner.

What is the driving force behind the significant growth in the area of veterinary pharmacy over the past ten to twelve years? The literature is replete with articles and commentaries that have a veterinary pharmacy focus, particularly compounding (DeBenedette, 1997; Ford and Gallon, 1997; Patterson, 1997; Samsot, 1997; Timmons, 1997; Paoletti *et al.*, 1998; Franck, 1998; Franck *et al.*, 1998; Allen, 1999a,b; Davis, 1997; 1999; Paoletti,

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1999; Sammarco, 1999; Hudson, 1999 Ahl, 2001; Bone, 2001; Yoakum, 2001; Miller, 2002). Literature focusing on veterinary pharmacy or veterinary compounding by pharmacists is almost totally absent before 1988.

One reason for this growth is the need for diversification in the community pharmacy sector. This is a result of the practice changes felt by independent community pharmacist with the advent of managed care and prescription drug benefit plans. About the time third party payers began gaining considerable market-share and offering contracts for reimbursement rates of perscription drugs dispensed under their plans, profitability for this sector of pharmacy was adversely affected. In an effort to maintain cash flow and diversify their businesses, pharmacists began looking for alternatives to support their practice. Compounding became a niche market to pharmacists. It is an avenue for pharmacists to use their knowledge, skills and abilities to provide compounded products to their patient population. Veterinary compounding is particularly appealing because it is also a niche market and has a unique patient population. The potential for economic gain is sizable, and one can find some articles and information sources that directly speak to increasing a pharmacy's profitability through veterinary compounding (Bradley, 1999).

The growth in veterinary pharmacy practice has not been paralleled with a growth in curricular offerings designed to educate practicing pharmacists in the areas of veterinary therapeutics, legal and regulatory issues, and veterinary informatics. Most of what pharmacists know about veterinary drugs and diseases is adapted from human medicine. Extrapolation from human medicine to veterinary medicine can be dangerous due to the many and varied species differences within veterinary medicine.

The lack of veterinary and animal health education in the pharmacy curriculum must be recognized. A few colleges or schools of pharmacy have curricular offerings on veterinary therapeutics, veterinary pharmacology or animal science topics (for example, Creighton University; Palm Beach Atlantic; Massachusetts; Campbell; University of Wisconsin; Midwestern University Chicago College of Pharmacy; University of Texas). To help practicing pharmacists develop new skills and expand their knowledge base in veterinary therapeutics, Creighton University School of Pharmacy and Health Professions developed an online continuing-education course in veterinary therapeutics. Pharmacists throughout the country can easily access this web-based course to gain up-to-date information and training in veterinary therapeutics, animal disease states and regulatory issues.

## PURPOSE

The purpose of this work is to describe the curriculum and to assess the effectiveness of the curriculum by measuring the cognitive knowledge of the pharmacists, as felt in their confidence level to explain common animal disease states, summarize veterinary pharmacotherapy options, and explain important regulatory documents that influence the practice of veterinary pharmacy. It is hypothesized that the pharmacist's confidence level will increase from the pre-course survey compared to the post-course survey by virtue of completing the curriculum. Reflective comments solicited from the pharmacists at the completion of the course on how they will use their new veterinary therapeutic knowledge base in their practice can offer insight into the motivations for practitioners to take the course.

This online continuing education (CE) course in veterinary therapeutics for practicing pharmacists was developed during the 2001 calendar year and made available in January 2002. The online course was specifically designed as an educational opportunity for pharmacists who are currently practicing, or may be considering practicing, in the rapidly expanding area of veterinary pharmacy. Post-graduate pharmacy education programs are popular offerings in many practice areas, but there is scant evidence on the educational outcomes of such programs in general in the pharmacy literature (Monaghan *et al.*, 2000).

## COURSE DESCRIPTION

Table I lists the global objectives and topic specific objectives for veterinary therapeutics, entitled "VET 101". All course materials were placed in the Blackboard® electronic learning environment to facilitate easy access for the students to the course documents, self-assessment quizzes and surveys. Technical and instructional design assistance was obtained from the Office of Information Technology and Learning Resources housed within the School of Pharmacy and Health Professionals.

Interested pharmacists can access an informational web site that lists the course objectives, hours of continuing education credit, registration form and cost at http://pharmacy.creighton.edu/veterinary therapeutics. The course materials are approved for 30 hours of continuing education credit by the Nebraska Council for Continuing Pharmaceutical Education (NCCPE), an American Council on Pharmaceutical Education (ACPE) approved provider of continuing education.

Pharmacists can access the web site at any time of the day or night and may print the materials for

TABLE I Course objectives

*Global education objectives:*

1. To enable pharmacists to analyze and argue the unique legal and regulatory restrictions applicable to veterinary medicine, food-animal medicine and compounding for animal patients by pharmacists and veterinarians. This includes evaluating the appropriateness of compounded medication request and applying ethical standards when providing services to veterinarians, animal owners and animal patients.
2. To enable pharmacists to explain and define the top 15 disease states in companion animals with particular emphasis on the ability to summarize pharmacotherapy options.
3. To prepare pharmacists to be able to 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.
4. To enhance the pharmacist's "non-linear" critical thinking skills needed when dealing with multiple animal species in unique circumstances to solve pharmaceutical-related problems.

*Topic specific objectives:*

Recall and explain Compliance Policy Guideline 608.400 "Compounded Drugs for Animals" and the Animal Medicinal Drug Use Clarification Act of 1994.

Identify, locate and interpret veterinary specific informatics.

List and describe pharmacotherapy options for these disease states or drug categories:

1. Feline diabetes
2. Canine diabetes
3. Equine protozoal myeloencephalitis
4. Keratoconjunctivitis in canines
5. Hypothyroidism in canines
6. Hyperthyroidism in felines
7. Primary idiopathic epilepsy
8. Urinary incontinence in canines
9. Addison's disease and Cushing's disease in canines
10. Separation anxiety in canines and felines
11. Osteoarthritis in canines
12. Otitis externa in canines and felines
13. Chemotherapy in companion animals
14. TPN in companion animals
15. Anesthetic and analgesic use in companion animals

Identify the most common oral pharmacotherapies for heartworm prevention in canines and felines.

Describe the human/animal bond and its positive effects upon human health.

Identify and discuss contemporary issues in veterinary medicine and veterinary pharmacy.

future reference. The course is self-paced with an open enrollment period. Students have six months to complete the course, and may request an extension if necessary. Upon completion of all self-assessment quizzes and surveys, the student notifies the instructor that they have finished the coursework, and their statement of CE credit and certificate is mailed to the student.

## COURSE CONTENT

The course content focuses on three areas: veterinary disease states and supporting informatics, legal and regulatory issues, and veterinary pharmaceutical classes. The information on veterinary disease states provides an introduction to veterinary therapeutics by detailing the pathology, signs and symptoms, diagnosis, pharmacotherapeutics, and prognosis for the 15 most common disease states affecting companion animals (dogs, cats and horses). Examples of the disease states covered are diabetes mellitus in canines and felines, thyroid disorders in canines and felines, osteoarthritis and separation anxiety. The veterinary and human labeled pharmaceuticals that are used to treat these disease states are listed and common dosages are supplied. Graphics that illustrate a specific disease presentation are incorporated in the text of each disease state. Graphics of veterinary pharmaceuticals used to treat the diseases are also presented. Additionally, veterinary text and internet-based references that can assist pharmacists in their practice of veterinary pharmacy are listed and described. URL's for each internet references are provided for the pharmacist to enter into a web browser and search for further drug information or animal disease state information.

There is heavy emphasis on the legal and regulatory documents influencing veterinary pharmacy. The Compliance Policy Guide (Section 608.400) "Compounding of Drugs for Use in Animals" and the Animal Medicinal Drug Use Clarification Act of 1994 (AMDUCA, 21 CFR Part 530) are presented and their importance explained. These items can give pharmacists valuable guidance and direction with regards to veterinary pharmacy and compounding. These regulatory documents are particularly useful in giving direction to the compounding pharmacist regarding regulatory discretion of compounding for companion animals versus illegal compounding for food animals. The compliance policy guideline delineates compounding activities that are of high regulatory priority. Pharmacists who practice any type of veterinary pharmacy need to have a complete understanding of these documents and be able to practically apply concepts from these documents to their practice environments. Additionally, the Drug Compounding Position Statement (American Veterinary Medical Association, 2001) adopted by the American Veterinary Medical Association is included to inform pharmacists of the issues identified in veterinary compounding brought forth by the membership of this veterinary organization.

Current topics from veterinary medicine and veterinary pharmacy are presented to supplement the readings on regulatory issues and document the need for a clear understanding of guidance documents and acts that directly affect the practice of veterinary pharmacy. Current articles and publications that focus on veterinary compounding and internet/mail order pharmacies are included

to highlight the many contemporary issues facing veterinary medicine and veterinary pharmacy today.

The third area of content focuses on broad pharmaceutical classes and their uses. Introductory information on heartworm preventatives is presented along with a discussion of heartworm disease. The dispensing of heartworm preventatives is a practice that is ideally provided by the prescribing veterinarian as a component of a best patient care. The purpose of presenting this topic is to encourage pharmacists to promote awareness of preventative pharmaceutical care for their veterinary patients. A section on antineoplastic use is included in the course materials. Common cancers affecting companion animals are presented and the use of chemotherapeutic agents in this population is discussed. Drug therapy protocols used to treat these specific cancers are included for informational purposes. Additionally, a section on anesthetic and analgesic use is included listing the drug names, indications and dosages. To round out the comprehensive therapeutic education, a brief section on the human-animal bond and its positive effects upon human health is presented and discussed.

## METHODS TO ASSESS CURRICULUM EFFECTIVENESS

Both quantitative and qualitative methods were used to assess the effectiveness of the CE curriculum. In the calendar year 2002, 30 ($n = 30$) pharmacists enrolled in VET 101 and 20 completed the course requirements ($n = 20$) by the end of the calendar year. A one group pre-post quasi-experimental design was used to evaluate the confidence level and application skills of the pharmacist-students. The online curriculum served as the intervention. All pharmacists are required to complete a 26 question pre-course survey to measure pharmacist knowledge or confidence levels on veterinary disease states, pharmacotherapeutics, and legal and regulatory issues. All pharmacists were also required to complete an identical 26 question post-survey to measure their knowledge or confidence level on the same topics after competing the curriculum. The surveys designed for this assessment used a five-point Likert scale (5 = strongly agree, 4 = agree, 3 = neutral, 2 = disagree, 1 = strongly disagree). Course related self-confidence surveys consist of questions designed to get an approximate measure of the students' self-confidence in relation to a specific skill or ability. These type of surveys help faculty assess their students' level of confidence in their ability to learn the relevant skills and material. When faculty can measure the student's level of confidence, and what affects that confidence, they can structure course materials in a way to build confidence and enhance learning (Angelo and Cross, 1993).

Reflective commentary in the form of responses to three questions was also collected. The first question, "What three items have you specifically learned from this course?" was intended to solicit insights on specific new knowledge gained from the course. The second question, "How will you utilize the items you learned from this course in your practice?" was designed to have pharmacists volunteer their thoughts about the relationship between the course content and their perceptions of how they will utilize this new knowledge in their practice environments. The third question, "Do you have any comments about this course?" was intended to obtain feedback about the course that could be used for overall improvement.

## RESULTS

Table II lists the pre- and post-course survey questions with their calculated medians. During the 2002 calendar year, 30 pharmacists enrolled in the course and completed the pre-course survey (100%) and 20 pharmacists completed all course requirements including the post-course survey (66.6%). The decreased number of pharmacists completing all course requirements, including the post-course survey, is due to the self-paced, open enrolment structure of the course.

Cognitive post-course scores improved significantly over the pre-course scores on all 26 items. Survey questions assessing the pharmacists' confidence in their ability to explain a veterinary disease state consistently increased by a ranking of 1.5 to 2 indicators on the post-course questions above the same pre-course questions. Survey questions measuring the pharmacists' confidence in their ability to summarize veterinary pharmacotherapy options for a disease state also consistently increased by a ranking of 2 or 3 indicators on the post-course survey questions compared to the pre-course survey questions. Questions pertaining to the application of legal and regulatory documents to assist the pharmacist in determining the appropriateness of a compounded product for an animal patient increased by a ranking of 1.5 to 2 on the post-course question analysis. Pharmacists reported the most confidence on both pre- and post-course questions in their ability to utilize veterinary informatics to locate dosages or disease state information. The final question, intended to measure the respondents confidence in their ability to meet state mandated counseling requirements for medications used in animal patients, resulted in the smallest increase in

TABLE II Survey results evaluating confidence indicators in veterinary therapeutic topics

| Survey questions | Medians | |
|---|---|---|
| | Pre-Course | Post-Course |
| 1. I feel confident in my ability to explain diabetes in canines | 2 | 4 |
| 2. I feel confident in my ability to explain diabetes in felines | 2 | 4 |
| 3. I feel confident in my ability to explain hypothyroidism in canines | 2 | 4 |
| 4. I feel confident in my ability to explain hyperthyroidism in felines | 2 | 4 |
| 5. I feel confident in my ability to explain equine protozoal myeloencephalitis | 2 | 4 |
| 6. I feel confident in my ability to explain keratoconjunctivitis sicca | 2 | 4 |
| 7. I feel confident in my ability to explain separation anxiety in canines and felines | 3 | 5 |
| 8. I feel confident in my ability to explain urinary incontinence in canines | 2 | 4 |
| 9. I feel confident in my ability to explain idiopathic epilepsy in canines | 2.5 | 4 |
| 10. I feel confident in my ability to summarize pharmacotherapy options for diabetes in canines | 2 | 4 |
| 11. I feel confident in my ability to summarize pharmacotherapy options for diabetes in felines | 2 | 4 |
| 12. I feel confident in my ability to summarize pharmacotherapy options for hypothyroidism for canines | 2 | 4 |
| 13. I feel confident in my ability to summarize pharmacotherapy options for hyperthyroidism in felines | 2 | 4 |
| 14. I feel confident in my ability to summarize pharmacotherapy options for equine protozoal myeloencephalitis | 2 | 4 |
| 15. I feel confident in my ability to summarize pharmacotheray options for keratoconjunctivitis sicca | 2 | 4 |
| 16. I feel confident in my ability to summarize pharmacotherapy options for separation anxiety | 2 | 5 |
| 17. I feel confident in my ability to summarize pharmacotherapy options for urinary incontinence in canines | 2 | 4 |
| 18. I feel confident in my ability to summarize pharmacotherapy options for epilepsy in canines | 2 | 5 |
| 19. I feel confident in my ability to summarize pharmacotherapy options for cancer in canines and felines | 2 | 4 |
| 20. I feel confident in my ability to summarize pharmacotherapy options for nutrition therapy in canines and felines | 2 | 4 |
| 21. I feel confident in my ability to summarize pharmacotherapy options for anesthetic and analgesic agents | 2 | 4 |
| 22. I feel confident in my ability to determine if a compounded would be appropriate for use in companion animals utilizing CPG 608.400 and AMDUCA | 2 | 4 |
| 23. I feel confident in my ability to determine if a compounded would be appropriate for use in food animals utilizing CPG 608.400 and AMDUCA | 2 | 4 |
| 24. I feel confident in my ability to utilize a text or internet reference to find a dosage for an animal patient | 3.5 | 5 |
| 25. I feel confident in my ability to utilize a text or internet reference to locate disease state information | 3.5 | 5 |
| 26. I feel confident in my ability to meet state mandated counseling requirements for medications used in an animal patient | 3 | 4 |

5 = Strongly agree, 4 = agree, 3 = neutral, 2 = disagree, 1 = strongly disagree.

ranking form the post-course survey compared to the pre-course survey.

Table III lists the results of the Wilcoxon signed-ranks analysis for each survey question. The analysis for each question resulted in statistically significant levels thereby indicating that the increase in the cognitive measure as reported by the pharmacist-student was not due to error. The null hypotheses of no increase in cognitive knowledge and skills between the pre-course survey and post-course survey can be rejected. Because the Blackboard® course platform cannot keep a record of specific pharmacists' responses to each question, the analysis was performed on each question individually versus matched pairs.

## THEME ANALYSIS OF REFLECTIVE COMMENTARY

Table IV lists representative comments from the three questions administered in the post-course survey. The responses relating to how the pharmacists will utilize concepts learned in the course to their practice, and the listing of three new items learned from this course followed similar themes. Generally, the pharmacists conveyed their appreciation for having the opportunity to take an online course on this subject matter. Specifically, knowledge on legal and regulatory issues and their positive influence on contemporary veterinary compounding was a recurring theme. Pharmacists repeatedly expressed

TABLE III Wilcoxon Signed-Ranks for each survey question

| Question number | | *N* | Sum | *Z** | *P* Sig. (2-tailed) |
|---|---|---|---|---|---|
| 1. | Neg. Ranks | 19 | 190 | −4.119 | $P < 0.0001$ |
| | Pos. Ranks | 0 | | | |
| | Ties | 1 | | | |
| | Total | 20 | | | |
| 2. | Neg. Ranks | 19 | 190 | −4.119 | $P < 0.0001$ |
| | Pos. Ranks | 0 | | | |
| | Ties | 10 | | | |
| | Total | 20 | | | |
| 3. | Neg. Ranks | 20 | 210 | −4.041 | $P < 0.0001$ |
| | Pos. Ranks | 0 | | | |
| | Ties | 0 | | | |
| | Total | 20 | | | |
| 4. | Neg. Ranks | 19 | 190 | −3.963 | $P < 0.0001$ |
| | Pos. Ranks | 0 | | | |
| | Ties | 1 | | | |
| | Total | 20 | | | |
| 5. | Neg. Ranks | 20 | 210 | −4.234 | $P < 0.0001$ |
| | Pos. Ranks | 0 | | | |
| | Ties | 0 | | | |
| | Total | 20 | | | |
| 6. | Neg. Ranks | 20 | 210 | −4.041 | $P < 0.0001$ |
| | Pos. Ranks | 0 | | | |
| | Ties | 0 | | | |
| | Total | 20 | | | |
| 7. | Neg. Ranks | 20 | 210 | −4.028 | $P < 0.0001$ |
| | Pos. Ranks | 0 | | | |
| | Ties | 0 | | | |
| | Total | 20 | | | |
| 8. | Neg. Ranks | 20 | 210 | −4.053 | $P < 0.0001$ |
| | Pos. Ranks | 0 | | | |
| | Ties | 0 | | | |
| | Total | 20 | | | |
| 9. | Neg. Ranks | 20 | 210 | −4.053 | $P < 0.0001$ |
| | Pos. Ranks | 0 | | | |
| | Ties | 0 | | | |
| | Total | 20 | | | |
| 10. | Neg. Ranks | 19 | 190 | −4.119 | $P < 0.0001$ |
| | Pos. Ranks | 0 | | | |
| | Ties | 1 | | | |
| | Total | 20 | | | |
| 11. | Neg. Ranks | 19 | 190 | −4.185 | $P < 0.0001$ |
| | Pos. Ranks | 0 | | | |
| | Ties | 1 | | | |
| | Total | 20 | | | |
| 12. | Neg. Ranks | 20 | 210 | −4.038 | $P < 0.0001$ |
| | Pos. Ranks | 0 | | | |
| | Ties | 0 | | | |
| | Total | 20 | | | |
| 13. | Neg. Ranks | 19 | 190 | −3.987 | $P < 0.0001$ |
| | Pos. Ranks | 0 | | | |
| | Ties | 1 | | | |
| | Total | 20 | | | |
| 14. | Neg. Ranks | 20 | 210 | −4.176 | $P < 0.0001$ |
| | Pos. Ranks | 0 | | | |
| | Ties | 0 | | | |
| | Total | 20 | | | |
| 15. | Neg. Ranks | 20 | 210 | −4.041 | $P < 0.0001$ |
| | Pos. Ranks | 0 | | | |
| | Ties | 0 | | | |
| | Total | 20 | | | |
| 16. | Neg. Ranks | 20 | 210 | −4.042 | $P < 0.0001$ |
| | Pos. Ranks | 0 | | | |
| | Ties | 0 | | | |
| | Total | 20 | | | |

TABLE III – *continued*

| Question number | | *N* | Sum | *Z** | *P* Sig. (2-tailed) |
|---|---|---|---|---|---|
| 17. | Neg. Ranks | 20 | 210 | −4.053 | $P < 0.0001$ |
| | Pos. Ranks | 0 | | | |
| | Ties | 0 | | | |
| | Total | 20 | | | |
| 18. | Neg. Ranks | 19 | 190 | −3.923 | $P < 0.0001$ |
| | Pos. Ranks | 0 | | | |
| | Ties | 1 | | | |
| | Total | 20 | | | |
| 19. | Neg. Ranks | 20 | 210 | −4.072 | $P < 0.0001$ |
| | Pos. Ranks | 0 | | | |
| | Ties | 0 | | | |
| | Total | 20 | | | |
| 20. | Neg. Ranks | 20 | 210 | −4.300 | $P < 0.0001$ |
| | Pos. Ranks | 0 | | | |
| | Ties | 0 | | | |
| | Total | 20 | | | |
| 21. | Neg. Ranks | 20 | 210 | −4.300 | $P < 0.0001$ |
| | Pos. Ranks | 0 | | | |
| | Ties | 0 | | | |
| | Total | 20 | | | |
| 22. | Neg. Ranks | 18 | 171 | −3.852 | $P < 0.0001$ |
| | Pos. Ranks | 0 | | | |
| | Ties | 2 | | | |
| | Total | 20 | | | |
| 23. | Neg. Ranks | 18 | 171 | −3.852 | $P < 0.0001$ |
| | Pos. Ranks | 0 | | | |
| | Ties | 2 | | | |
| | Total | 20 | | | |
| 24. | Neg. Ranks | 12 | 78 | −3.357 | $P = 0.001$ |
| | Pos. Ranks | 0 | | | |
| | Ties | 8 | | | |
| | Total | 20 | | | |
| 25. | Neg. Ranks | 13 | 91 | −3.500 | $P < 0.0001$ |
| | Pos. Ranks | 0 | | | |
| | Ties | 7 | | | |
| | Total | 20 | | | |
| 26. | Neg. Ranks | 17 | 153 | −4.025 | $P < 0.0001$ |
| | Pos. Ranks | 0 | | | |
| | Ties | 3 | | | |
| | Total | 20 | | | |

*Based on positive ranks.

their new knowledge of veterinary informatics and how their use of text and Internet references would enhance their ability to problem-solve issues relating to veterinary disease states and pharmacotherapy. Lastly, pharmacists reported that their increased knowledge base in all topic areas would enhance their ability to communicate with veterinarians about drug therapies as well as give them the cognitive resources needed to provide insightful counseling to owners on their animal's drug therapy.

Responses to the questions soliciting general input on the course reflect quality-of-life issues that are important for full-time pharmacists who engage in an online course. Responses reflected enjoyment derived from obtaining new knowledge and an appreciation of flexibility that is allowed with a self-paced, structured, online course. Additionally, there were several comments stating that the content was well written and presented in a logical format.

The results of four post-course survey questions that did not directly relate to the educational objectives of the course offered insight into the learning experience reported by the pharmacists. A full 100% of post-course respondents reported that they would recommend this course to a friend. Also, 100% of the respondents strongly agreed, or agreed with the statement that they had a positive impression of the CE course in veterinary therapeutics. And, 100% of the respondents strongly agreed, or agreed that the subject matter of veterinary therapeutics was interesting. The last question pertained to the instructions for accessing

TABLE IV Reflective comments from post-course survey

*1. What three items have you specifically learned from this course?*

The Legal and Regulatory issues were new to me. I've practiced long enough that I've seen many of the treatments before but not taking any veterinary courses before I had no idea what regulations surrounded the use of medications.

The resources listed in this course, especially the web sites provided have served as great references for myself and for my patient pet owners. I have a better knowledge of the commercial drugs available to vets and a better understanding of the nature of compounding for animals.

There is a need to educate the public that a pharmacist also is aware of various disease states and treatments for ill pets. The material covered in this course adds to my personal and professional knowledge and I can use the knowledge to enhance not only my reputation as an informed pharmacist but also increase sales.

What are reliable references are out there for veterinary pharmacy, websites for veterinary pharmacy and distinct differences in responses to medications by dogs and cats versus humans

I had forgotten some of AMDUCA that was covered in this course. In addition, I learned more about diagnostic procedures in cases involving EPM and Addison's disease.

When I first started my part-time job as a veterinary pharmacist, I felt very overwhelmed by the unfamiliarity and complexity of Veterinary Pharmacy. I didn't know where to begin to learn what I would need to know to feel more confident and knowledgeable in my new position. Thankfully, your course provided a great starting place for my learning, and also a very practical and informational platform for me to build on.

The most useful is the availability of references both of text and internet nature. The second was the information from the chemotherapeutic course as I personally have 2 dogs with cancer. The third was the information on separation anxiety because I also train dogs and encounter many questions on that subject from people.

I learned a great deal about canine incontinence causes and treatment options for my own dog. I learned more of the signs to look at for thyroid problems and the treatment regimens for diabetes will also be useful to my practice.

*2. How will you utilize the items you learned from this course in your practice?*

I have a very large animal hospital and a zoo near where I practice. This information will become a reference for future use and I'm sure I will find myself reviewing it often.

I will be more informed on treatment options and doses when discussing compounded therapy with vets.

My practice is a veterinary hospital so this information will be used constantly.

I will use this information to more confidently interact with vets as I attempt to expand our compounding services.

I work in a compounding pharmacy doing mostly veterinary medication. I had worked in retail pharmacy for 25 years before entering this field. It is a real treat to find some information on the problems we face every day. Thanks!!!!!

I will utilize the information in my work as a hospital pharmacist due to occasional requests from vet offices as well as in my personal life as a pet owner.

I feel that the course gave me a background on some of the more uniquely veterinary disease states. Also, the course helped to teach me how certain disease have a different course in veterinary patients.

I plan to use the printed course materials as a reference in my pharmacy practice. I have already come home and reviewed specific topics when I've had questions in my own mind or from clients, and I needed to review what I had learned to feel more proficient in that area. This course is so valuable that I am sure that I will utilize this course in innumerable ways that I can't even imagine right now.

All of the information is useful for me personally as a dog lover and owner. Thank you!

*3. Do you have any comments about this course?*

I found the course to be very enjoyable. Information was presented in a logical, understandable manner.

The quiz questions could be a little more challenging.

Great use of the internet to provide CE!! Very well organized and will serve as a great reference.

I was hoping for more information on side effects in animal use, as I often get these types of questions. All in all, I thought it was a good over view.

This course, "Veterinary Therapeutics," is one which most Pharmacists should take not only as C.E. but also in pharmacy school. The reason being is that as a retail pharmacist and one working in hospital pharmacy at times, I have had patients ask pharmaceutical question about their pets.

I enjoyed this course and am glad to have the information and resources provided.

I really liked the course, just wish there was more!!!

I think that the course was well written and covers the topics thoroughly. It was easy to follow.

EXCELLENT course!! I am a beginning Veterinary R.Ph., and I am so grateful for this learning opportunity and all the work you have done to make this course available. I found the course content to be very useful, informational and "just right" in depth. I also liked the format of the course. It is definitely the most valuable and practical Pharmacy CE I have ever taken. I can't say enough good things about it, and I hope you are considering offering a Veterinary Therapeutics II. I'll be the first to sign up for it!

I enjoyed learning about drug therapy in animals. There was a lot of good information provided.

Enjoyed the format of the course and the ease of fitting it into my schedule.

I am really glad to see a course devoted to veterinary pharmacy. I am asked to do a lot of compounding for animals in my practice. I also train dogs and teach at a training center and am asked many questions because I am a pharmacist.

the online course. Fifty-three percent strongly agreed, 32% agreed and 16% responded neutral that the directions were adequate. This may be an indicator that the printed materials detailing access to the course may need to be reassessed for clarity.

## INSTRUCTOR REFLECTIONS

The online course fills a need for educational offerings on the subject of veterinary pharmacy. The interest in this practice area has grown tremendously and this course is the first online, post-graduate

curricular offering provided through an accredited school of pharmacy. This course is the first of its kind to offer the opportunity for education to all interested pharmacists regardless of geographical barriers. Additionally, there is benefit to the profession as a whole in making the course available to all interested pharmacists. The positive feedback received from pharmacists who have completed the course has made the teaching experience rewarding and enjoyable.

The positive comments from pharmacists regarding the structure of the course, ease of navigation and logical presentation of course materials is thought to be a direct result of the guidance and direction received from instructional designers in the Office of Information Technology and Learning Resources. Clearly, the input and advice given to the instructor on successful teaching strategies and best practices in electronic-based distance education was beneficial to the instructor and well received by the pharmacists.

The Blackboard® course platform has proven to be an exceptional tool for the delivery of this continuing education course. Administrative issues such as ease of student enrollment and the quick ability to generating access codes for enrolled students are definite benefits to this particular platform. In this platform, the author has observed a history of ease-of-use and negligible technology problems with user access.

## LIMITATIONS

While the Blackboard® platform is an effective tool for the delivery of course materials to this particular population, it is limited in its ability to collect individual pharmacist data on the pre- and post-course surveys. The platform can collect and present survey results as a group, but it lacks the capability to collect and report on individual responses to each survey question, which in turn, limits the type of statistical test that can be used to analyze the educational outcome data. Additionally, the open enrollment, self-paced nature of this course resulted in 30 pharmacists beginning the course in 2002 and 20 completing the course by the end of 2002. The difference in numbers of pharmacists ($n = 10$) who completed the pre-course survey and post-course survey was allowed for in the Wilcoxon signed-rank test.

Other limitations to this evaluation are that the one group, pre- and post-test design is not particularly strong. Issues of internal and external validity are present. The presentation of identical survey questions in a test-re-test scenario may have accounted for the improvement seen in the post-test medians. Another limitation to this outcome analysis is that all respondents to the surveys were self-selected as evidence by their desire to enroll in the online course.

## DISCUSSION

The educational outcomes of this CE course in veterinary therapeutics have been positive. The results show that an online post-graduate course in veterinary therapeutics for practicing pharmacists can be used to increase the confidence level in the pharmacist's cognitive knowledge and skills after completion of the curriculum. Table II shows consistent increases in the post-course survey question medians indicative of short-term, and perhaps long-term cognitive knowledge in veterinary therapeutics.

Survey results indicated that pharmacists' confidence improved in all areas relating to the global course objectives. The online offering of this course appears to be an effective method to educate pharmacists on topics specific to veterinary pharmacy.

The growth in veterinary pharmacy has allowed pharmacists to apply their drug knowledge resources to veterinary situations. This is accomplished by providing drug information and therapeutic recommendations to veterinarians, animal owner consultation and education, and compounded drug products. 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. Pharmacists, by being one of the most accessible health care professionals, can provide owner consultation and education on dispensed pharmaceuticals or on animal disease states that have similar monitoring parameters to human disease states such as diabetes. Currently, there are few outlets for all interested pharmacists to gain comprehensive education on concepts critical to the practice of veterinary pharmacy, but this has not deterred the growth of this special area of practice.

The educational curriculum and the profession of pharmacy as a whole, has historically focused on the human species as the center of disease state and drug therapy management. The profession has undergone dynamic revisions in order to prepare practitioners to provide pharmaceutical care. The inclusion of curricular offerings or course content focusing on animal patients is not a standard offering among schools and colleges of pharmacy. One practical approach to this educational void is to

provide the needed information to post-graduate practicing pharmacists via distance education courses. The natural outgrowth of this CE course at Creighton University has been the offering of an online course in veterinary therapeutics for all interested pharmacy students. This course is available to any student enrolled in a professional pharmacy degree program. While the online educational offerings on the subject of veterinary pharmacy are trailing the explosive growth curve in this area, the need has been recognized and it is available to practicing pharmacists as well as to undergraduate pharmacy students.

## IMPLICATIONS

Education of pharmacists on veterinary acts and guidelines has the potential to positively impact the practice of veterinary pharmacy and veterinary medicine by assisting pharmacists in being compliant with state and federal laws that affect this practice specialty. There is a need for education of pharmacists who desire to offer products and services to veterinarians, as well as education for veterinarians who seek to use these products and services.

A 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 to veterinary medicine and animal health for the ultimate benefit of animal patients.

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