A Mixed-Methods Analysis of Changing Student Confidence in an Online Shelter Medicine Course

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ABSTRACT

Maddie's Shelter Medicine Program at the University of Florida College of Veterinary Medicine offers comprehensive training in shelter medicine to veterinary students based on a set of core job skills identified by the Association of Shelter Veterinarians. In 2012, this program began teaching online distance education courses to students and practicing veterinarians worldwide who sought additional training in this newly recognized specialty area. Distance learning is a novel educational strategy in veterinary medicine; most instruction at veterinary medical schools is classroom based. No previous studies have shown whether online courses can prepare veterinarians to practice shelter medicine. In this study, we investigated how an online, graduate-level course titled "Shelter Animal Physical Health" changed student self-reported confidence. First, we compared pre-course confidence regarding eight specific shelter medical practice scenarios to post-course confidence through statistical analysis. Quantitative analysis showed a significant ($p < .001$) increase in self-reported confidence for all eight scenarios. Next, we used open coding to identify themes within reflection papers that students were asked to write during the course and used those findings to corroborate or refute the quantitative results. Qualitative analysis of students' reflection papers identified six themes: confidence, communication, population management, outbreak management, medical care, and application. The results of this study show that distance education can be an effective method of preparing veterinarians and veterinary students to practice shelter medicine.

Key words: shelter medicine, online education, distance learning, confidence, self-efficacy, distance education, educational technology

INTRODUCTION

Shelter medicine has recently been recognized as a separate and important sub-specialty of veterinary medicine. The Association of Shelter Veterinarians (ASV), formed in 2001, now includes more than 1,500 national and international members.[1] Since 2004, national conferences have offered continuing education tracks in shelter medicine topics. Residencies and internships, many with applications through the formal "match" process, are now available at select veterinary colleges and high-functioning shelters.[2] Veterinary schools have begun offering elective courses in shelter medicine topics. In 2011, the American Board of Veterinary Practitioners (ABVP) and founding members of the ASV conducted a job task analysis with the assistance of the Ohio State University to identify the diverse skills and knowledge a highly qualified shelter veterinarian should possess.[1] In 2014, the formation of an ABVP board specialty in shelter medicine was announced.[3] The first candidates took the shelter medicine board exam in November 2015. In addition, past and current research performed at multiple academic and shelter institutions offers a strong evidence-based body of research to guide the practice of shelter veterinarians.[4–6]

Despite formal recognition in the wider veterinary community, few comprehensive training and university-based academic opportunities are available to veterinarians and veterinary students interested in studying the diverse topics that make up shelter medicine.[2] These topics include the study of infectious diseases such as kennel cough/upper respiratory infection, specialty surgery techniques in high volume, and high-quality spay/neuter, but they also span architecture and facility design, population management, animal behavior, welfare of captive animals, outbreak and disaster management, marketing, nonprofit management, forensics, public health, euthanasia, and sanitation.[7] Increasingly, humane societies and animal control organizations are seeking veterinarians with experience and current knowledge in shelter medicine.[8]

One of the few avenues available to veterinary students and veterinarians who want to pursue advanced education in shelter medicine is the online Graduate Certificate in Shelter Medicine, provided by Maddie's Shelter Medicine Program (MSMP) of the University of Florida. This certificate allows veterinarians, residents, interns, and veterinary students from around the world to receive academic instruction from recognized experts in shelter

medicine by completing three courses (nine university credits) in "Integrating Shelter Systems with Veterinary Medicine," "Shelter Animal Physical Health," and "Shelter Animal Behavior and Welfare." Distance education courses have distinct advantages over classroom-based courses because they permit adult learners and instructors to participate from any geographic location, and interact with content at their own pace, and conform to any work schedule. Real-time events can be offered live for those who can attend or they can be recorded for later access. Out-of-state students benefit by paying lower tuition costs. Academic institutions benefit by collecting additional tuition from nonlocal enrollments. However, disadvantages also exist, including perceived disconnection between student and instructor, the requirement of student computer technical proficiency, depersonalization, loneliness, absence of a learning community, and the potential for academic dishonesty. There are also concerns about identity safety, legitimacy of providers, and the quality of the offerings.[9] Online courses such as those offered in this veterinary graduate certificate program are relatively new pedagogical platforms for graduate-level instruction.

One major concern for those of us teaching in a new field using a new platform is how well the students feel that their learning experience prepares them to respond to real challenges in the field. Quantitative tools, such as surveys and Likert scales, are frequently used in education research to measure changes in student beliefs. These tools indicate direction and magnitude of any change, if present. Pre-course examinations and surveys have been shown to enhance learning.[10] Qualitative tools help us understand how and why these changes take place. The use of student compositions and expositions can be analyzed to recognize common response themes. In this course, graded reflective writing assignments were originally given to all students to promote learning. Reflective writing provides students with opportunities to (1) describe events and feelings they experience, (2) analyze reactions or meaningfulness, (3) consider alternative responses, and (4) ponder what actions they might exercise in future instances that are similar.[11–14] These assignments can catalyze knowledge growth and attitude change over time.[15–18] Reflective writing can be a powerful form of feedback for students; simply thinking, talking, or reading about new knowledge is likely not sufficient to evoke change.[19] The analysis of student reflective writing also offers faculty with valuable insight about participants' sense of how they integrate new and existing knowledge.[20–22]

This mixed-methods study examines statistical changes in self-reported confidence of students who enrolled in and completed the 2014 "Shelter Animal Physical Health" (SAPH) online course, and analyzes the language students used to describe their impressions of the course material in reflective writing assignments. We hypothesized that online training would change the confidence of participants in one of two directions: if the course helped students feel they had mastered the content and could apply newly learned skills and knowledge, their confidence would increase. However, if the course helped students see how much more they still needed to master before they could practice successfully, confidence might decrease.

METHODS

Curriculum Design

Development of the course curriculum used a "backward design" process, starting with the ASV job task analysis created in 2007 and revised in 2011.[23] Major professional tasks identified in this document were reorganized as learning outcome targets for higher-level thinking skills identified on Bloom's Taxonomy of educational objectives.[24,25] Higher-level outcomes are not easily assessed with quizzes and multiple-choice exams, so we constructed multiple modalities to assess student learning, including activities and projects that allowed for both formative and summative feedback on student work, scored by both peers and instructors against grading rubrics.[26] After the learning outcomes and assessments were developed, we started planning the instructional activities needed to achieve our educational objectives. The course was divided into eight digital chapters and delivered over a 15-week semester. Lessons within each chapter were structured around the 5E Instructional Model, commonly used in science education to promote active learning and address cognitive learning theory.[27,28]

Quantitative Study Methods

After receiving University of Florida Institutional Review Board (IRB-02) approval #U-882–2014 for "Assessment of Effectiveness of Teaching Shelter Animal Physical Health Using Distance Education Technology," students enrolled in the fall 2014 semester of SAPH were invited via email to fill out the pre-course survey. The first survey question asked for informed consent to participate in this research project and included identification of risks to the student and explanation of anonymity and separation of survey participation from any grading. Every student who completed the survey also agreed to participate in the research project. Each student then created a unique identifier that could not be guessed and this identifier was then used to match pre- and post-course surveys. The second set of questions asked students to report particular demographic information (gender, age, current position, location). Since three of the authors were active instructors and/or teaching assistants for SAPH (TS, LD, JA), the investigators performing the qualitative and quantitative analyses were blinded to the names of the students answering survey questions and writing reflection papers. An invitation to participate in a similar end-of-course survey was emailed to the same students in December 2014.

In each survey, eight hypothetical shelter medicine scenarios (see Table 1) were presented to the students. These eight scenarios were selected because they were realistic for shelter practice, matched tasks listed in the 2011 ASV Job Task Analysis,[23] fit with SAPH course objectives, and were addressed within multiple chapters in the course.

Students were asked to select their level of confidence addressing each scenario using the 5-point Likert scale

Table 1: Student survey scenarios in relation to ASV job task code and SAPH course chapter

Survey scenario	Job task	Chapter
Scenario 1: You confirm dermatophytosis in a group of shelter cats. The shelter operations manager asks you to design a safe and effective housing and sanitation protocol for these cats.	A-1 Design sanitation and disinfection protocols for animal shelters A-8 Manage disease outbreaks in animal shelters C-1 Design zoonoses control programs in animal shelters	2, 3, 4, 7
Scenario 2: The shelter's executive director asks for your input on next year's preventative care budget. The ED needs a detailed list of which vaccines, diagnostic tests, and parasite treatments to purchase; how many to budget for; and an explanation for the board about why the expenditures are necessary.	A-11 Design protocols for individual patient care in the shelter A-5 Design vaccination protocols for shelter animals F-1 Advise on resource allocation in animal shelters (personnel, budget)	2, 3, 4
Scenario 3: An adoption-guarantee facility is concerned about how long it takes for their pets to find homes. They seek your advice on how to better manage their population so they can save more lives.	A-14 Advise on population management/density in animal shelters A-16 Advise on medical selection criteria within animal shelters (e.g., adoption, treatment, fostering) B-1 Establish behavioral selection criteria for shelter animals (e.g., adoption, treatment, euthanasia) B-9 Promote acceptable quality of life for shelter animals	5
Scenario 4: A municipal shelter received a warning that shelter staff members were using improper euthanasia techniques. They seek your input on improving their euthanasia protocols to comply with local regulations and improve humane handling of animals.	A-17 Design euthanasia protocols for animals shelters (e.g., technical training, body disposal) F-3 Advise on legal medical record keeping in animal shelters F-4 Consult on animal shelter regulations (e.g., OSHA, DEA) F-5 Advise on compassion fatigue in animal shelters G-5 Provide expertise on animal shelter ethical issues	6
Scenario 5: The local animal shelter just impounded 100 dogs from a hoarding investigation. They need a plan from you for housing and caring for these animals until the investigation is complete.	E-4 Provide humane animal capture, transport, and housing in animal cruelty, abuse, and neglect cases E-5 Manage animal cruelty, abuse, and neglect-victim rehabilitation	2, 3, 4, 8
Scenario 6: The shelter's board of directors decides its current record-keeping system is inadequate for managing shelter operations and medical care. They seek your advice on which shelter software system might better suit their needs.	F-2 Design animal identification tracking and data analysis systems for animal shelters F-3 Advise on legal medical record keeping in animal shelters A-15 Develop medical record-keeping systems for animal shelters	3, 5, 8
Scenario 7: Shelter volunteers complain that medical staff don't promptly treat the animals when needed. They ask for a better way to communicate their concerns so animals don't have to wait for care. They ask you for a plan to improve communication in the shelter.	A-11 Design protocols for individual patient care in the shelter A-9 Design disease surveillance program in animal shelters A-13 Create medical and surgical protocols for animal shelters	2, 3, 4, 7, 8
Scenario 8: A municipal shelter reports a particularly high rate of coughing dogs. Some have died. They suspect this is an outbreak, but they don't know the cause. They ask you to help them diagnose the problem and help them manage the outbreak so they don't have to euthanize the population.	A-2 Design biosecurity procedures for animal shelters (e.g., quarantine, segregation, traffic patterns) A-6 Design infectious disease protocols for shelter animals (e.g., parasitic, bacterial, viral) A-7 Diagnose disease outbreaks in shelter animals H-4 Communicate with the public as an expert on shelter medicine issues	4, 7, 8

Table 2: Reflective writing paper questions

Question 1	Describe at least one new concept or fact you discovered as a result of this chapter.
Question 2	What questions or concerns did this chapter raise for you or what would you like to know more about as a result of this chapter?
Question 3	Give one idea you intend to use in your work.

provided (1 = *extremely unconfident* to 5 = *extremely confident*). The Likert scale is a well-defined tool used to rate student confidence in medical educational research; confidence is frequently used as an indicator of effectiveness of education,[29–32] since measuring technical proficiency in fields like medicine, dentistry, and nursing can be difficult.

Using a paired-samples *t*-test with 95% confidence intervals (CIs), we compared data collected in the pre-course survey given to SAPH students in August of 2014 to data collected in the end-of-course survey given in December of 2014. Analysis was performed with the IBM statistical software program SPSS.[a] Data collected on the pre-course survey were also analyzed for internal consistency using Cronbach's alpha to provide a reliability estimate for the confidence measure.

Qualitative Methods

During the 15-week course, students were required to submit at least three reflective writing papers, with extra credit offered for submitting any additional papers. Table 2 shows questions students were asked to address. Only papers submitted by students who had given informed consent were used, and student identification was removed before analysis. The software program NVivo[b] was used to analyze the thematic content of the papers.[33] For each reflective writing paper, a minimum of two trained research assistants created initial codes and analyzed the text in the papers using line-by-line coding. Next, a codebook was developed that described each code's definition and specified when to use and not to use the code for each chapter.[34] The two researchers then coded 10 reflective writing papers using the codebooks for each selected chapter. Codes were compared, and the codebook was updated based on disagreement and coding differences. The process continued until satisfactory agreement was reached between coders for each item in each chapter.

Once the codebooks were finalized, two researchers independently coded all of the papers within three selected chapters (chapters 2, 5, and 7). These chapters represented the beginning, middle, and end of the course. Inter-coder reliability was calculated using SPSS to obtain Cohen's kappa for each code. All kappa values calculated were above the cutoff value of .67.[35] Next, the team of researchers came together to draft a set of themes. Themes were reviewed and discussed among the researchers. Definitions were created for each theme, and codes were placed under the relevant theme to prepare for analysis. After reaching consensus in identifying the themes, conceptual definitions were developed. Representative examples related to each theme were then identified when they occurred in each reflective writing paper.

RESULTS

Demographic Comparisons

Out of 61 students enrolled in the course, 48 students answered the first survey and 22 students provided full responses to both surveys. To investigate how similar our student population was to individuals currently practicing shelter medicine, we compared demographic data collected for those participating in both surveys to demographic data in the 2011 veterinary wage survey[36] published on the ASV's Veterinary Information Network (VIN). This comparison showed that students had relatively similar characteristics (see Table 3) to those practicing shelter medicine in the US in the past 5 years. One major difference was that fewer SAPH students were over 55 years old in 2014 than were represented in shelter practice in 2011. In addition, veterinary students, US veterinarians, and international veterinarians responded to our course surveys, while the VIN questionnaire only surveyed veterinarians in practice in the US.

Quantitative Results

Statistical analysis showed a significant increase in student self-reported confidence between pre-course and post-course surveys for all eight presented scenarios. Mean differences in Likert scores for the eight scenarios ranged between 0.86 points (95% CI = 0.494–1.233) in scenario 1 (dermatophytosis) and 1.5 points (95% CI = 0.938–2.153) in scenario 6 (shelter software). All differences were positive, as seen in Figure 1.

Mean differences in pre- and post-course scale ranking were within 95% CIs, and two-tailed p values were less than or equal to .001. Table 4 shows statistical change in confidence for each scenario.

Cronbach's alpha calculated for the pre-course survey results used in the comparison was .83. No scenario if deleted gave a value less than .79. This measure indicates that 83% of the variation between summed student scores can be considered reliable variance. Essentially, this indicates that our survey questions were internally consistent. Cronbach's alpha values over .7 are considered acceptable for social science research.[37]

Qualitative Results

Six themes emerged from qualitative analysis of the reflection papers: confidence, communication, population management, outbreak management, medical care, and application (see Table 5).

Confidence

This theme was expressed as the ability or knowledge to do something well, and was mentioned by all of the participants.

Table 3: Demographics of SAPH 2014 students ($n = 52$)

	Student characteristic	Total	Percentage	Percentage in 2011 VIN/ASV wage survey ($n = 196$)
Gender	Male	33	**14%**	**11%**
	Female	19	**86%**	**89%**
Age*	18–24	2	9%	Not Asked
	25–34	6	**27%**	**26%**
	35–44	9	**41%**	**36%**
	45–54	4	**18%**	**23%**
	55+	0	**0%**	**12%**
Occupation*	Vet student: UF	4	18%	None surveyed
	Vet student: other	1	5%	None surveyed
	Veterinarian: US	14	64%	100%
	Veterinarian: international	2	9%	None surveyed

* Denotes one non-respondent

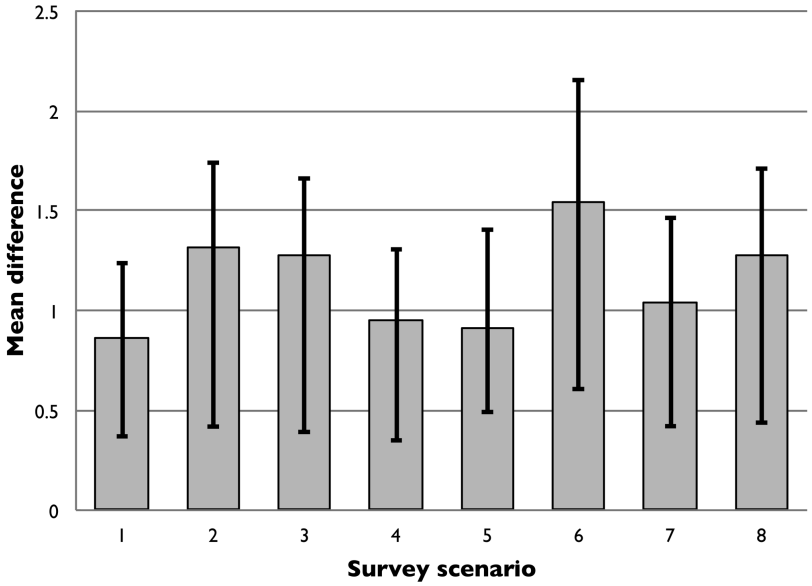

Figure 1: Mean difference in student confidence on pre- and post-course surveys (responses on a 5-point Likert scale with 95% CI as error bars)
All values are statistically significant ($p < .001$).

One participant described how her "Microsoft Excel skills vastly improved." Another wrote that having the opportunity to "manage large amounts of data with Excel [helped her] gain valuable insights about the shelter population." One participant stated that she "had no idea there was so much that could be done with the multitude of data points collected on animals in a shelter!" Another participant explained how a video and description of the population management steps helped him "see the application of the management strategies." One participant felt newly able "to improve shelters by looking at the data and identifying weak points that may be overlooked without thousands of data points." Another participant looked "forward to using all the calculations contained within the Population Management chapter" since before this, he was "unfamiliar with the methods for calculating these numbers."

While discussing euthanasia, one participant had learned "which data points to use to calculate this [live release] rate." Others reported how data analysis could facilitate "the ability to single out and target a few areas that will make a noticeable difference versus trying to tackle the many problems that have been developing for a long period of time all at once."

One of the participants reported learning how to conceptualize the process of isolation procedures, and now felt that "this information could be shared easily with staff in a way to easily reference that information." One

Table 4: Paired-samples *t*-test, pre- and post-course surveys results

Scenario	Mean difference	*SD*	*SEM*	95% CI: lower	95% CI: upper	*t*	*df*	*p* (2-tailed test)
1	0.864	0.834	0.178	0.494	1.233	4.860	21	<.001
2	1.318	0.945	0.202	0.899	1.737	6.539	21	<.001
3	1.273	0.883	0.188	0.881	1.664	6.763	21	<.001
4	0.955	0.785	0.167	0.606	1.303	5.700	21	<.001
5	0.909	1.109	0.236	0.417	1.401	3.846	21	.001
6	1.545	1.371	0.292	0.938	2.153	5.288	21	<.001
7	1.045	0.950	0.203	0.624	1.467	5.161	21	<.001
8	1.273	0.985	0.210	0.836	1.709	6.062	21	<.001

SEM = standard error mean

Table 5: Theme definitions and representative examples

Theme	Conceptual definition	Example
Confidence	The belief in someone's ability to learn or do something	"I have many new concerns about the level of care at my shelter [...] [though] I feel better prepared to approach the director with a plan to fix the SOPs and the intake policies in our clinic."
Communication	Written or spoken information that is shared with others, including protocol (written guidelines developed by a shelter or veterinarian) and records (tracking, organizing, or keeping records or a database of animal or shelter records)	"I've been helping to write SOPs for the past couple years. However, they have lacked multiple useful characteristics suggested in this chapter. Going forward, I will be sure to utilize the suggestions regarding consistency/format, pertinent information, and ease of reading/use."
Population management	Management of animal population, including incoming, outgoing, in-shelter, and foster animals	"I learned multiple ways to decrease length of stay, including managing intake and providing other options instead of entering the shelter."
Outbreak management	Procedures or actions taken to address a disease outbreak in a shelter	"understanding how the disease behaves (physiology and pathology) [and making] decisions to effectively stop the outbreak and save as many lives as possible."
Medical care	Medical, sanitation, or other procedures to prevent, treat, or control disease or improve a condition	"I often just focused on the animal health impact of a disease outbreak in a shelter, but overlooked the impact it can have on the shelter as a whole."
Application	Discussing whether something (e.g., protocol, software, policy) is applicable or practical to them or someone/something else	"I intend to use better data collecting methods in my work because of this lecture. My organization does a lot of data collecting, but I am always on the periphery of it. I would like to get more involved in it and this lecture provided some good tools to do that."

participant reported having acquired great ideas on how to distribute Standard Operating Procedures (SOPs) and make them available to staff. She had "updated three SOPs in [her] organization, already created a training program to review SOPs and a shared drive to make them available to everyone." One participant reported feeling "better prepared to approach the director with a plan to fix the SOPs and the intake policies in [the] clinic." Another participant reported increased confidence in her comfort "in advising how to manage the cats."

Communication

This theme refers to the sharing of information with others, including the use of medical protocols, SOPs developed by a shelter or veterinarian, and shelter records used to organize and track animal data.

Learning strategies to distinguish clean and contaminated housing areas led one participant to begin "improving [...] communication to staff by writing a protocol about management strategy for different diseases." Participants discovered that there were "many considerations when preparing an intake and wellness checklist for a shelter." One student had never "considered the reading level of the person who is reading the checklist." Another wrote that "tailoring a checklist for the weekend staff member who admits a dog to the shelter that was left on the shelter's doorstep overnight" was likely to be crucial to ensuring "the wellbeing of the animal and the other shelter animals."

Others reported having a better understanding of the importance of SOPs and why they needed to "do a better job of writing them at work." Participants began to appreciate that SOPs standardized shelter expectations while keeping "everyone informed" and helping "ensure best practices" and "avoid miscommunications and misleading assumptions."

Participants reported a better understanding of the intersection between the law and shelter medicine. One participant had "a clearer understanding of [...] local laws and how grey they are with regards to shelters practicing medicine." Another "found it difficult to work out a protocol to reflect the World Small Animal Veterinary Association's vaccine guidelines while keeping in in mind the differences in perception of 'core' vaccines" in his location. One participant shared that he wanted to "learn more about [...] whether shelters keep records about how they dealt with and hopefully overcame an outbreak," since this information could be "useful for other shelters or newbies in the field (such as me) to see first-hand how a shelter dealt with this situation."

Population Management

This theme refers to managing the animal populations, including incoming, outgoing, in-shelter, and foster animals.

According to one participant, "discussion of bottlenecks and different pathways out of a shelter is something that my shelter could use to look at and change. We have a lot of spay/neuter bottlenecks right now because our spay/neuter clinic is still being built." He planned to identify resources "like the 'wait till eight' or 'ready-set-go' programs for use in my shelter before we can safely get them spayed/neutered."

One participant shared that she could "now better understand how to prioritize shelter projects, how to rate the progress of projects, and how to allocate resources." Another participant stated that she learned "how to sort/filter the data from a shelter to evaluate for bottlenecks and increased length of stay for some groups." One student described having learned "multiple ways to decrease length of stay, including managing intake and providing other options instead of entering the shelter."

The course helped one participant feel confident in his ability to develop potential solutions, but he reported concerns about the parameters used in reporting data. He questioned what would happen when different definitions were used for live intake, such as when "one shelter may add in a dog that was found and recovered an hour later and one may not." Another participant "found it interesting that owner-requested euthanasia is not included in the calculations for live-release rates," and wondered "how one decides what to include and what not to include to end up with the most accurate data."

One participant who currently practiced primarily on client-owned animals reported that reading about population management prompted him to "have many questions about the inner workings and decision making in my local shelter." A practitioner who worked in a private shelter/foster-care group planned to find out "what software they are using and encourage them to collect as much information on each animal as possible so that they can start doing some analysis and provide objective information on length of stay, capacity of care, and budgeting" to the shelter.

Outbreak Management

This theme refers to procedures or actions taken to address an infectious disease outbreak in a shelter.

For one student, discussing infectious disease management provided "extremely valuable information to help identify and make crucial decisions when faced with an outbreak situation." This participant recognized the importance of "understanding how the disease behaves (physiology and pathology) [and making] decisions to effectively stop the outbreak and save as many lives as possible." Another stated that he had not previously known about "the idea of a clean break to separate the ill and exposed from the new healthy intakes." Many participants now felt "well prepared with how to advise and logically deal with a pathogen outbreak."

One of the students reported having a better understanding of when to consider medical quarantine. Describing a previous outbreak of *Streptococcus zooepidemicus var equi* at his shelter, he asked himself how many "dogs were exposed and/or died because the shelter did not impose a quarantine." He wrote that it is "so easy to let yourself get pushed into making rash decisions, skipping steps (like proper quarantine of exposed animals) and what that has meant for community and shelter populations because of it."

Several participants learned how "press releases could actually aid a shelter's reputation by providing transparency in explaining how it handled and managed the situation by limiting the lives lost." One hoped to get his board "to understand that informing the public or adopters of animals prior to identification of the first sick animal is a good thing!" Another student explained how being transparent could "decrease rumors and actually get the public on your side." He decided to remember this strategy rather than "feel ashamed that something happened under my watch."

One participant reported enjoying reading scientific research to support many of the things she already knew, and suggested "research like this would be good to cite when trying to modify vaccination policies in a shelter where people may be resistant to change." Another found it "good to review that even shelters with strict adherence to vaccine guidelines are still threatened by

outbreaks because of housing immature animals that have ineffective responses to vaccines." One participant "didn't know squat about feline calicivirus." She explained that she wanted "to research it more since it seems like a poorly understood or at least poorly controlled virus." Another participant wrote that he still wanted "to learn more about specific diagnostics that can be used on an individual or population scale."

Medical Care

This theme refers to sanitation, preventive care, medical treatment, and other strategies used to control disease or improve a health condition.

Participants described how their awareness of prevention, treatment, and controlling diseases improved as a result of taking this distance education course. One considered "the use of the new Bordetella vaccine administered through the oral mucosa" for ease of administration, because his staff had difficulty following the SOPs "due to the varied capabilities of staff required to do intake (including kennel staff, dispatchers, animal-control officers, and technicians) and the reality that they typically do intake by themselves." His primary concern was to ensure that "vaccines are administered well enough to be effective." Another participant reported that "vaccination protocols in a shelter are vastly different from those in private practice" and realized "the importance of vaccinating the majority of pets as soon as possible or immediately at intake, both for their own health and for the health of the population."

In a discussion of the canine distemper virus antibody-titer test, one student learned how test results could be easily confounded by the presence of maternal antibodies, and explained that he would now be "aware when testing animals that are clinically suspicious for canine distemper." One participant had a new appreciation for the difficulty of "balancing a budget against the standard of care [with the] increasing price of medications." Another reported having a better understanding of the "balance between animal factors, pathogen factors and environment that mean an animal either gets a disease or it doesn't. [...] I knew it before, but being made to think about it some more in relation to these shelter animals made it more real." One participant reported learning "some interesting details about ringworm, like black lights are not sufficient substitutes for Wood's lamps, and chlorhexidine shampoo is ineffective against it."

Application

This theme refers to the usefulness or practicality of information learned in the course to participants in their line of work. Participants described how what they learned in the course was applicable or practical.

For example, one participant confessed having written many SOPs that "lacked multiple useful characteristics suggested in this chapter." Another participant planned to "take my newly written intake checklists and compare them to our current checklists to see if I can make any improvements. I am glad to have refreshed my understanding of the accepted vaccination guidelines for shelter animals." Another student stated that she would set up "clean breaks that are manageable next time I have an infectious disease outbreak."

One student found that "charts depicting each disease and the flow through the hospital are great references and [I plan to] utilize these to handle any outbreaks I face." Another planned to "evaluate the length of stay in shelter animals and evaluate the cost effectiveness of switching to Ivermectin doses once a month after an intake treatment of Advantage Multi." By doing this, she hoped to determine if it "truly would save a significant amount of money for the shelter while maintaining a healthy shelter population." One participant intended to implement "better data collecting methods" to get more involved in the analysis of his organization's data collection. Another student planned to "keep in mind the possibility of pre-intake actions that can be taken to pretreat and even prevent an animal from coming into the shelter to begin with."

DISCUSSION

Our data show that students felt significantly more confident in their ability to address a range of shelter medicine scenarios after completing the online fall 2014 SAPH course. Student reflection papers submitted at three points during the course addressed themes of confidence, communication, population management, outbreak management, medical care, and application during their semester-long learning experience. The mix of quantitative and qualitative analysis used in this study gives us a window into student meaning making, as communicated through student reflection papers, particularly with novel concepts like population management or outbreak management. This helps us understand that certain course concepts were particularly important for bolstering student confidence. The use of reflection papers with feedback from instructors in a safe and collegial environment provided opportunities for students to deliberately practice and rehearse the use of new knowledge and skills before entering into medical practice with live shelter animals. This process of slowly creating expertise guided by mentoring with practice over time has been described previously by Ericsson as a method for building self-confidence.[38] Because increased self-confidence seems to correlate with students' willingness and ability to perform tasks, the results of this study support the effectiveness of distance education as a component in preparing veterinarians to practice shelter medicine.

Especially valuable to this group of online students was the course content that helped guide them in developing best practice SOPs for managing the health and well-being of large populations of shelter animals. These skills and knowledge were represented by themes of in-shelter communication, population management, outbreak management, and shelter animal medical care. We surmise these students either held prior misconceptions in these areas, or that their prior knowledge was undeveloped during previous veterinary training.

Students also highlighted the applicability of the instructional content as important to their learning. This finding agrees with what is already known about successful adult learning: adult learners require instruction

that is immediately relevant and useful in their daily practice.[39–42] Demographic analysis of this group of students showed they were closely aligned to (although slightly younger than) the population of veterinarians currently in shelter practice in the US; this is likely because many SAPH 2014 students were also practicing shelter vets. This finding suggests that the SAPH course was effectively teaching skills and knowledge applicable to current shelter practice.

University faculty members are sometimes reluctant to teach online because they fear that such instruction is inferior to traditional face-to-face instruction. However, many online courses (such as this one) adhere to best practices for instructional design as described in manuals like the University of Florida's Standards and Markers of Excellence.[43] It is reasonable to assume that the quality of online instruction can meet or exceed that of face-to-face instruction. One important difference is that creating and delivering quality online courses is particularly time-consuming. SAPH 2014 required a team of experts in the subject, instructional designers, and audio-visual support specialists across the country working together for at least 6 months to create one course for online delivery to 61 students.

Limitations

The results of this study are limited by the fact that self-reported confidence levels represent only an estimate of effective instruction and practice readiness. A better measure of new abilities might require students to demonstrate proficiency in person using trained observers rating performance on real tasks. Example assessments could include using an objective structured clinical examination or using direct observation of practice. Clinical skills taught by distance learning technologies may be inferior to clinical skills taught by hands-on mentored training.[44]

Small survey-based studies such as this one may be subject to selection bias. While 22 out of 61 students in the class completed both pre- and post-surveys (a relatively high participation rate of 36%), there could be an important difference between respondent and non-respondents. For example, it is possible that more satisfied and engaged students were motivated to respond while disgruntled students were less likely to respond. Providing incentives to increase response rate might increase the sample size, but could also introduce a coercive bias and prevent students from answering questions honestly.

While this study demonstrates that online training can be a viable method for preparing veterinarians for shelter medicine practice, the results should not be generalized to other areas of veterinary education, given the unique curriculum and the small, non-randomly selected sample of students. It does, however, support previous findings from other medical disciplines about the effectiveness of quality online training.[44]

CONCLUSION

Despite the limitations of self-reporting and small sample size, using a mixed-methods analysis in this study provided insights that can direct future shelter medicine and online education investigations. With only a quantitative analysis, we would have seen a significant change in student confidence but would not have understood what factors influenced the change. With only a qualitative analysis, we might have understood some of the factors that affected student confidence but would have lacked a measure of how much it changed and in which direction. By using both, we were able to corroborate the significant increases in student confidence with a contextual understanding of which new skills and concepts were important to students' learning experience.

Follow-up investigations are needed to help determine whether increased student confidence remains stable over time; for example, it would be interesting to repeat this study with the same students 6 to 12 months in the future. It would also be interesting to compare class-bound students to online students taking the same course, and to compare similar courses at different institutions.

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CONFLICT OF INTEREST

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NOTES

a IBM SPSS Statistics for Windows, IBM Corporation, version 21.0, released 2012

b NVivo qualitative data analysis software, QSR International Pty Ltd., version 10, 2012

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