8-13-2024

Veterinary Students' Perceptions Toward Incorporating and Expanding Telehealth Service Delivery Knowledge in Curricula and Future Practice: A Cross-Sectional Study

Kylie Watson
Lincoln Memorial University

Nikhil M. Mardhekar
Lincoln Memorial University

Utkarsh Pandey
Lincoln Memorial University

Julia Wells
Lincoln Memorial University

Karen Gruszynski
Lincoln Memorial University

See next page for additional authors

Recommended Citation

Watson K, Mardhekar NM, Pandey U, Wells J, Gruszynski K, Wilkerson AH, Dascanio JJ, Quadri SS, Leo JT, Samuel KD, Nahar VK, Davis RE. Veterinary Students' Perceptions Toward Incorporating and Expanding Telehealth Service Delivery Knowledge in Curricula and Future Practice: A Cross-Sectional Study. *American Journal of Veterinary Research*. 2024; . doi: 10.2460/ajvr.24.02.0032.

Authors

Kylie Watson, Nikhil M. Mardhekar, Utkarsh Pandey, Julia Wells, Karen Gruszynski, Amanda H. Wilkerson, John J. Dascanio, Syed S. Quadri, Jonathan T. Leo, Krishen D. Samuel, Vinayak K. Nahar, and Robert E. Davis

AJVR

AVMA

Veterinary students' perceptions toward incorporating and expanding telehealth service delivery knowledge in curricula and future practice: a cross-sectional study

Kylie Watson, DVM, MS[1]; Nikhil M. Mardhekar, BS[2]; Utkarsh Pandey, BS[2]; Julia Wells, DVM[1]; Karen Gruszynski, DVM, MPH, PhD[1]; Amanda H. Wilkerson, PhD[3]; John J. Dascanio, VMD[4]; Syed S. Quadri, PhD[2]; Jonathan T. Leo, PhD[5]; Krishen D. Samuel, PhD[6]; Vinayak K. Nahar, MD, PhD[7,8]; Robert E. Davis, PhD[6]*

[1]Center for Animal and Human Health in Appalachia, College of Veterinary Medicine, Lincoln Memorial University, Harrogate, TN
[2]DeBusk College of Osteopathic Medicine, Lincoln Memorial University, Harrogate, TN
[3]Department of Health Science, The University of Alabama, Tuscaloosa, AL
[4]Texas Tech School of Veterinary Medicine, Amarillo, TX
[5]Department of Pathology and Anatomical Sciences, Kansas City University, Kansas City, MO
[6]Department of Health, Substance Use and Mental Health Laboratory, Human Performance and Recreation, University of Arkansas, Fayetteville, AR
[7]Department of Dermatology, School of Medicine, University of Mississippi Medical Center, Jackson, MS
[8]Department of Preventive Medicine, School of Medicine/John D. Bower School of Population Health, University of Mississippi Medical Center, Jackson, MS

*Corresponding author: Dr. Davis (red007@uark.edu)

OBJECTIVE
Telehealth is the use of technology to deliver medical services. Potential uses among veterinarians include consulting with specialists about complicated cases, sending in electronic prescriptions, or meeting with clients to discuss patient health. Although the coronavirus disease 2019 pandemic posed many challenges to the veterinary profession, it accelerated the adoption of telehealth among veterinarians. As many of these changes took place quickly in response to the pandemic, many of those in practice did not receive much training or guidance; therefore, this study explores veterinary students' perceptions regarding incorporating telehealth into the veterinary curriculum and the utilization of telehealth in the future.

METHODS
An email survey was sent to students at a veterinary school.

RESULTS
80 students provided answers to the 11-question survey. Nearly 80% reported that it is either "important" or "very important" to incorporate telehealth training into the veterinarian curriculum, whereas almost 90% indicated that they would benefit from more telemedicine training prior to graduation. Almost 75% of participants had legal and malpractice concerns, which may present a barrier to using the technology upon graduation.

CONCLUSIONS
This study suggests that veterinary schools should explore how to incorporate telehealth training into their curriculum, especially in regard to navigating the potential pitfalls that may be encountered when employing telehealth within the context of a veterinarian-client-patient relationship.

CLINICAL RELEVANCE
Telehealth is a valuable tool, and its use has become commonplace. Educational programs that emphasize telehealth will better equip future clinicians to manage the nuances of this modality in practice.

Keywords: COVID-19, electronic prescriptions, healthcare, technology, telemedicine

Received February 13, 2024
Accepted July 30, 2024
Published online August 13, 2024

doi.org/10.2460/ajvr.24.02.0032

Telehealth, the remote distribution of healthcare materials, education, or care, and its subsidiaries (telemedicine, teletriage, teleconsulting, others)[1] have become a growing area of interest in veterinary medicine. One telehealth platform, Medici, reported

a 48% spike in veterinary registrations in the month of March 2020.[2] Additionally, a 2021 survey study of veterinarians concluded that both caseload and utilization of telehealth expanded during the coronavirus disease 2019 (COVID-19) pandemic.[3] Although the COVID-19 pandemic served to initiate growing interest in telehealth in the veterinary profession, the benefits of telehealth services have led many in the industry to predict that telehealth will continue to serve a valuable role in the profession long beyond the pandemic.[4] As of 2022, the market size of veterinary telehealth globally was approximately 150 million US dollars; forecast has suggested a compound annual growth rate of 17% from 2023 through 2030.[5]

The Veterinary Virtual Care Association is a global nonprofit devoted to establishing best practices and standards for virtual veterinary care.[6] The recent State of the Veterinary Virtual Care Industry Report referenced 2023 as a crucial point in the evolution of virtual care given the wide-spread growth in utilization of veterinary telehealth and telemedicine over the past few years (2020 through 2024) and the associated data that has been generated through this expansion.[6] Key report findings indicate a veterinary coverage shortage in the US; roughly 60,000 more veterinary staff members are needed to bring underserved areas to the average provider coverage experienced across the country. For example, approximately 22% of US counties do not have representation by a single veterinary employee. Data collected in the US, Canada, and United Kingdom overwhelmingly supports veterinary telehealth, with 98.4% of consumers reporting at least a 4 out of 5 on a global satisfaction survey and the majority reporting a resolution of their pet's issue. Finally, the report documents key care principles for veterinary telemedicine in the US and calls for standardized legislation of veterinary telemedicine across the US.[6]

Given the previous and ongoing role of telehealth in the veterinary profession, researchers have proceeded to study how veterinarians and clients perceive this new industry segment. Prior to the pandemic, a pilot study[7] in 2019 assessed veterinarians' knowledge and attitudes toward telehealth and concluded that veterinarians overall embodied a lack of knowledge of telehealth and a lack of utilization in practice. An additional study[8] showed that owners felt favorably toward telehealth, specifically the use of videoconferencing opposed to an in-room exam for surgical rechecks. In a 2020 study[3] on veterinarians' perceptions of telehealth, the top perceived benefits associated with its implementation were safety, positive feedback from clients, and efficiency. However, in the same study, 45% of the respondents that reported challenges ranked acceptance and training of personnel as a top challenge of implementing telehealth services within their clinics.

Although certain veterinarians and clients value telehealth more than others, veterinary telehealth presents many benefits and, thus, may remain relevant well past the COVID-19 pandemic.[9] The convenience, enhanced continuity of care, and ease of incorporation of specialists into primary practice are a few of the reasons why industry professionals predict that the use of veterinary telehealth services will continue to increase.[9] For this reason, it is important to begin introducing telehealth concepts to future veterinarians in veterinary school. Currently, multiple organizations offer continuing education programs to educate licensed veterinarians on telehealth practices.[10] Interestingly, in 2020 the USDA sponsored a partnership with Iowa State University and one such telehealth education company, VetNow, establishing a proof-of-concept test of how telemedicine technology could be used to instruct complicated practice techniques.[11,12] Using this partnership with VetNow, 1 veterinary school has already implemented telehealth into its swine production education for students.[12]

As veterinary telehealth education is integrated into veterinary schools across the country, it is imperative to understand how veterinary students feel about these changes as they are ultimately the future of the industry. Currently, no research has been conducted on veterinary students specifically in regard to attitudes toward telehealth and the intention to utilize telehealth upon graduation. Given the steady increase in telehealth incorporation in the industry and the importance of veterinary students in paving the way for the industry's future, the lack of understanding of how veterinary students view telehealth has sparked concern. The objective of the current study was to explore veterinary students' attitudes and perceptions toward telehealth, specifically focused on their future intention to use telehealth as the primary outcome of interest.

Methods

Participants and procedure

In September 2021, veterinary students at a private college of veterinary medicine in the Appalachian region of the US were recruited to participate in this cross-sectional survey study. They were contacted via email, which explained the research study And its purpose and provided a link to the online questionnaire. Students were notified that participation in the study was completely voluntary and that they were permitted to withdraw at any point. Upon clicking the link, students agreed to participate in the study. All responses to the survey were collected anonymously and kept confidential. Data were collected over a 3-week period, with reminder emails sent after the first and second week. The research study was reviewed and approved by the university's institutional review board (protocol #1019 V.0).

Instrumentation

The online survey contained 27 items and was estimated to take approximately 5 minutes to complete. Four questions assessed basic demographic data, including gender, academic classification, whether the participant was a first-generation college student, and whether they were from the Appalachian region.

Perceived importance of telemedicine training from veterinary schools was measured using a single

item with 5-point scoring, ranging from "not at all important" to "very important." Four items assessed perceptions of *telehealth-related training adequacy* provided by their veterinary school, each scored on a 5-point disagree-to-agree scale. For example, "I have received a sufficient amount of training in veterinary school on the legal framework surrounding veterinary telemedicine." *Perceived benefits* toward telemedicine utilization in practice was assessed using 6 items scored on a 5-point disagree-to-agree scale. For example, "Offering veterinary telemedicine visits improves client compliance." *Perceived barriers* to telemedicine use was measured with 1 item. Respondents were instructed to select all that apply, with higher scores indicating more anticipated barriers to practice. Sample options were "technology difficulties," "malpractice or legal issues," and "not preferred by clients." One item measured future *intentions for telemedicine use*, "How often do you plan on utilizing veterinary telemedicine in your practice upon graduation." This item was scored on a 5-point frequency scale, ranging from "never" to "always." Finally, participants were asked to indicate the *most appropriate telemedicine medium* to utilize when providing care for various prominent conditions necessitating veterinary appointments. Answer choices ranged from telehealth services, such as live video consult and digital photo, to in-person consult only.

Data analysis

Data analysis for the current study was conducted in SPSS, version 28 (IBM Corp). We first calculated descriptive statistics for study variables in the form of means and SDs or frequency and percentage as appropriate. Next, relationships between variables were measured and reported in the form of Person product moment correlation coefficients. Using ordinary least squares multiple regression, we examined the ability of constructs to predict intentions to use telemedicine in future practice. Additional variables exhibiting a significant relationship with intentions for future use were included in this modeling as covariates. Finally, we reported endorsements of the most appropriate telehealth methods for evaluation and diagnosis as well as anticipated barriers to future telemedicine use in the form of frequency and percentage.

Results

In total, 80 veterinary students participated in the survey. Of the 80 students, 66 were women and 14 were men **(Table 1)**. Participation was fairly evenly distributed across academic years, with 28.7%, 30%, 27.5%, and 13.8% among first-year students, second-year students, third-year students, and fourth-year students, respectively. Among the 80 students, 78.8% were not from the Appalachian region. Of the participants, 78.8% reported that it is either "important" or "very important" to incorporate telehealth training into the veterinarian curriculum, and 88.8% reported that they would benefit from more telemedicine training prior to graduation (Table 1).

Table 1—Descriptive characteristics of the study sample (n = 80).

	n (%)
Gender	
Female	66 (82.5)
Male	14 (17.5)
Academic classification	
First-year student	23 (28.7)
Second-year student	24 (30.0)
Third-year student	22 (27.5)
Fourth-year student	11 (13.8)
First generation student	
No	55 (68.8)
Yes	25 (31.3)
Are you from Appalachia	
No	63 (78.8)
Yes	17 (21.3)
Importance of incorporating telehealth training into curriculum	
Low	8 (10.0)
Neutral	9 (11.3)
Important	43 (53.8)
Very important	20 (25.0)
Would you benefit from more telemedicine training prior to graduation	
No	9 (11.3)
Yes	71 (88.8)

When plotted for correlation, there was a positive correlation (r = 0.584) between students who recognize the importance of telemedicine in training and their intention to use telemedicine in future practices **(Table 2)**. In addition, when comparing the perceived need for more telemedicine training and the importance of telemedicine in the curriculum, there was a positive correlation (r = 0.247). There was also a positive correlation between participants who believed in the benefits of telemedicine use and intention to use telemedicine in future practice, importance of training in curriculum, and perceived need of telemedicine training (r = 0.680, 0.679, and 0.271, respectively). Interestingly, there was a negative correlation (r = 0.363) between students who perceived the need for more telemedicine training and perceived telehealth confidence (Table 2). Additionally, participants who perceived the importance of telemedicine use or noticed benefits for telemedicine had more intent to use it in future veterinary practices **(Table 3)**.

When asked about specific conditions, participants believed that live video consultation was either as appropriate or more appropriate than in-person consultation **(Table 4)**. For example, for surgical follow-up and behavioral conditions, there was a greater number of students who found live video consultation more appropriate than in-person consultation (38 vs 28 students for surgical follow-up and 15 vs 9 students in behavioral). When compared to in-person consultation, students did not believe that audio-only or text-only communication was as beneficial for most conditions, indicating a desire for a visual component in virtual care.

When asked about barriers to future telemedicine use, most students cited technologic difficulties and the potential for legal issues and malpractice as

Table 2—Correlation matrix of study variables.

Variable	1	2	3	4	5	6
1. Intention to use telemedicine in future practice	—	.584***	.062	.680***	.041	−.095
2. Importance of telemedicine training in veterinary curriculum		—	.247*	.679***	−.079	.015
3. Perceived need for more telemedicine training[a]			—	.271*	−.363**	.041
4. Benefits of telemedicine use				—	−.046	−.031
5. Perceived telehealth confidence					—	−.051
6. Perceived barriers						—
Mean	2.90	3.94	0.89	20.95	9.86	3.49
SD	0.70	0.88	0.32	4.93	3.42	1.34
Possible range	1–5	1–5	1–2	6–30	4–20	0–7

***$P < .001$; **$P < .01$; *$P < .05$.
[a]All correlations with this variable are point biserial correlations as this variable is dichotomous.

Table 3—Multiple linear regression model for intentions to use telemedicine in future veterinary practice.

Independent variables	*b*	SE	*B*	*P*	LBCI	UBCI
Importance of telemedicine training in veterinary curriculum	0.202	0.089	0.251	.026	0.025	0.379
Perceived telehealth confidence	0.007	0.018	0.035	.690	−0.029	0.043
Perceived need for more telemedicine training	−0.291	0.200	−0.132	.150	−0.690	0.108
Benefits of telemedicine use	0.078	0.016	0.544	< .001	0.046	0.109
Perceived barriers	−0.039	0.043	−0.075	.357	−0.124	0.046

Model statistics: adjusted $R^2 = 0.485$, $F_{(5,74)} = 15.86$, $P < .001$.
LBCI = Lower bound of the 95% CI. UBCI = Upper bound of the 95% CI.

Table 4—Most appropriate telemedicine method for evaluation and diagnosis of common nongeneral wellness-related veterinary clinic visitations and anticipated barriers to telemedicine utilization.

Condition	Telephone (audio only)	Live video consultation	Text message or email exchange	Stored digital photo	In-person consultation only (telemedicine is not appropriate)
Skin condition	1 (1.3)	29 (36.3)	3 (3.8)	12 (15.0)	35 (43.8)
Ear infection	3 (3.8)	16 (20.0)	4 (5.0)	2 (2.5)	54 (67.5)
Eye condition	1 (1.3)	13 (16.3)	2 (2.5)	3 (3.8)	60 (75.0)
Mass/bump/lump	1 (1.3)	9 (11.3)	3 (3.8)	3 (3.8)	64 (80.0)
Gastrointestinal symptoms	14 (17.5)	23 (28.7)	5 (6.3)	0 (0.0)	36 (45.0)
Possible urinary tract infection	11 (13.8)	11 (13.8)	2 (2.5)	0 (0.0)	56 (70.0)
Behavioral condition	15 (18.8)	51 (63.7)	5 (6.3)	0 (0.0)	9 (11.3)
Surgical follow-up	0 (0.0)	38 (47.5)	5 (6.3)	9 (11.3)	28 (35.0)
Chronic disease management	12 (15.0)	20 (25.0)	3 (3.8)	0 (0.0)	44 (55.0)
Anticipated barriers to future telemedicine use					
Technology difficulties					52 (65.0)
Lack of satisfactory platform to conduct telemedicine visitations					40 (50.0)
Lack of training in veterinary telemedicine					44 (55.0)
Difficulty in determining charges for telemedicine visitations					47 (58.8)
Malpractice and legal issues					60 (75.0)
Not preferred by clients					22 (27.5)
Other					19 (23.8)

Values reported as frequency and percentage. Percentages may not total 100 because of missing data in the form of participant omission.

barriers to telemedicine use. Out of those 2, almost 75% cited malpractice and legal use as a barrier to future telemedicine use. Finally, there was a general fear of misdiagnosis in the participants that reported "other."

Discussion

A large percentage of veterinary students appeared to be confident in the benefits of telehealth and would like to use it in their future practice. This study showed that veterinary students believe that they would benefit from more open training on the benefits and methodology of telemedicine. In fact, students who were not confident in telehealth also perceived more need for telehealth training. A recent study[3] has shown telehealth challenges, with the top challenge being training personnel. As a result, we recommend that there should be a comprehensive telehealth training module incorporated into the veterinary curriculum. Students may be offered the option to opt in or out of the training depending on

if they plan on or anticipate using telehealth or not. The strongest positive correlation was between students who believed in the benefits of telemedicine and students who planned on using telemedicine in their future practice. As a result, a module on the benefits of telemedicine use should be incorporated. An effort should be made to provide more confidence in telehealth as well.

Most veterinary students preferred live video conferencing over face-to-face interactions in some instances whereas not preferring calling and emailing in most instances. As a result, due to the high confidence of video calls, instruction and teaching should be focused on modalities with video capabilities. There were also multiple concerns, especially with the legality and fear of providing poor care through misdiagnosis. This is most likely due to inexperience and confidence on diagnosis and evaluation in a telehealth environment. Veterinary students should be trained in the correct techniques and methods to navigate through an increasing legal landscape. Overall, this study showed the need for more telemedicine training as well as students' willingness to incorporate training in their veterinary classes.

Future avenues of study could include doing a wider study to include students from multiple veterinarian colleges. A larger sample size would be beneficial to fully explore the parameters assessed in this study with respect to intentions to practice telemedicine in the future as well as perceived barriers to implementing telehealth in practice by future veterinary students. A future endeavor could also involve the creation of a dedicated telehealth module developed in collaboration with practicing veterinarians who incorporate telehealth services. This should be accompanied by subsequent evaluation to assess the impact that more specialized telehealth- and telemedicine-specific education has on veterinarian students' intentions to practice telemedicine in the future.

Limitations were present due to the methodology used in the study. First, data were self-reported through an online questionnaire, which may have imposed potential influences of response bias, such as social desirability bias. Second, the study was cross-sectional in nature, which prevents any determination of causation and directionality between the variables. Third, the sample included predominantly women, which may limit the generalizability to students who were men. Findings from this study should be corroborated by collecting data from more diverse student populations, including students at public institutions and in other regions of the US.

The COVID-19 pandemic compelled many medical providers, including veterinarians, to incorporate telehealth services into their practices without much notice or experience with technology prior to implementation. To understand the future of telehealth in the veterinary profession, the study surveyed veterinary students to ascertain their views toward telehealth training and potential use upon graduation. Participants were recruited from 1 private college of veterinary medicine in the Appalachian region of the US; however, 78.8% were not from the Appalachian region, indicating a likely extension of study findings beyond this region of the country. Many students perceived the benefits of telehealth as practicing veterinarians; however, other students expressed apprehension regarding the use of telehealth due to legal and malpractice concerns. Students also expressed the need to include telehealth in the veterinary student curriculum, so veterinary schools should consider addressing both the benefits and barriers to featuring telehealth as a service in practice.

Acknowledgments

None reported.

Disclosures

The authors have nothing to disclose. No AI-assisted technologies were used in the generation of this manuscript.

Funding

The research was funded by the authors' departments.

ORCID

Robert E. Davis https://orcid.org/0000-0002-7873-8051

References

1. Veterinary telehealth: the basics. AVMA. Accessed February 16, 2022. https://www.avma.org/resources-tools/practice-management/telehealth-telemedicine-veterinary-practice/veterinary-telehealth-basics
2. Barrett S. Vet telehealth surges as first US pets test positive for coronavirus. CNBC. April 23, 2020. Accessed February 16, 2022. https://www.cnbc.com/2020/04/23/vet-telehealth-surges-as-first-us-pets-test-positive-for-coronavirus.html
3. Dubin RJ, Angliss G, Eng C, Cisneros T, Griffon D. Veterinarians' perceptions of COVID-19 pandemic–related influences on veterinary telehealth and on pet owners' attitudes toward cats and dogs. *J Am Vet Med Assoc.* 2021;259(10):1140–1147. doi:10.2460/javma.21.04.0203
4. Cerda ADL. The rapid rise of veterinary telehealth. DVM 360. August 12, 2020. Accessed February 16, 2022. https://www.dvm360.com/view/the-rapid-rise-of-veterinary-telehealth
5. Veterinary telehealth market size, share & trends analysis report by animal type (canine), by service type (telemedicine), by region (North America, Europe, Asia Pacific, Latin America, MEA), and segment forecasts, 2023 - 2030. Grand View Research. 2024. https://www.grandviewresearch.com/industry-analysis/veterinary-telehealth-market#
6. 2024 state veterinary virtual care industry report. Veterinary Virtual Care Association. 2024. Accessed July 12, 2024. https://vvca.org/2024-industry-report/
7. Watson K, Wells J, Sharma M, et al. A survey of knowledge and use of telehealth among veterinarians. *BMC Vet Res.* 2019;15(1):474.
8. Bishop GT, Evans BA, Kyle KL, Kogan LR. Owner satisfaction with use of videoconferencing for recheck examinations following routine surgical sterilization in dogs.

J Am Vet Med Assoc. 2018;253(9):1151–1157. doi:10.2460/javma.253.9.1151
9. Salois M, Golab G. Telehealth: more than a pandemic stop-gap. DVM 360. July 14, 2021. Accessed February 16, 2022. https://www.dvm360.com/view/telehealth-more-than-a-pandemic-stop-gap
10. Telehealth resource center. VetFolio. Accessed February 16, 2022. https://www.vetfolio.com/pages/resource-center-telehealth
11. Veterinary Medicine Academia Partners: VetNOW Virtual Care. Veterinary telemedicine platform for veterinary specialty care. VetNOW. Published August 1, 2020. Accessed February 16, 2022. https://vetnow.com/academia/
12. Taking swine medicine education into the virtual world. Iowa State University News Service. December 15, 2021. Accessed July 12, 2024. https://www.news.iastate.edu/news/2021/12/15/veterinarytelehealth